U. S. F. W. S. Spec. Sci. Report - Fisheries

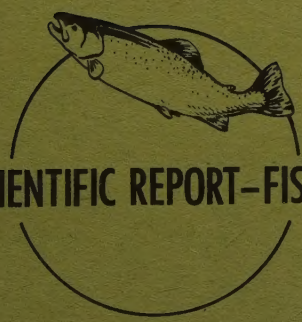
LIBRARY

APR 12 1960

FISH & WILDLIFE SERVICE

#328

SARDINE EGGS AND LARVAE AND OTHER FISH LARVAE PACIFIC COAST, 1957



SPECIAL SCIENTIFIC REPORT–FISHERIES No. 328

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Explanatory Note

The Special Scientific Report series comprises results of investigations, usually of restricted scope, intended to aid or direct management or utilization practices and as guides for administrative or legislative action. Reports in this series are issued in limited quantities for the official use of Federal, State, or other cooperating agencies, and in processed form for economy and to avoid delay in publication.

United States Department of the Interior, Fred A. Seaton, Secretary
Fish and Wildlife Service, Arnie J. Suomela, Commissioner

SARDINE EGGS AND LARVAE AND OTHER FISH LARVAE PACIFIC COAST, 1957

by

Elbert H. Ahlstrom
Fishery Research Biologist
Bureau of Commercial Fisheries
La Jolla, California

United States Fish and Wildlife Service
Special Scientific Report--Fisheries No. 328

Washington, D. C.
December 1959

TABLE OF CONTENTS

	Page
Area covered, 1957	3
Methods of sampling	5
Abundance of fish larvae in1957	5
Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712	8
Record of sardine eggs, 1957	18
Record of sardine larvae, 1957	27
Record of anchovy larvae, 1957	37
Record of the larvae of the jack mackerel (Trachurus symmetricus), 1957	59
Record of the larvae of the Pacific mackerel (Pneumatophorus diego), 1957	73
Record of the larvae of the hake (Merluccius productus), 1957	79
Record of the larvae of rockfish (Sebastodes spp.), 1957	89
Literature cited	98

FIGURES

Nos.

1.	Station plan, 1957, of the California Cooperative Oceanic Fisheries Investigations	2
2.	Sardine eggs, 1957: Distribution and relative abundance	20
3.	Sardine larvae, 1957: Distribution and relative abundance	26
4.	Anchovy larvae, 1957: Distribution and relative abundance	36
5.	Jack mackerel larvae, 1957: Distribution and relative abundance	60
6.	Pacific mackerel larvae, 1957: Distribution and relative abundance	72
7.	Hake larvae, 1957: Distribution and relative abundance	78

TEXT TABLES

Nos.		Page
1.	Coverage during 1957	4
2.	Abundance (standard haul totals) of fish larvae in 1957, summarized by month	6
3.	Temperature ranges and means for stations containing sardine eggs in 1957, summarized by month and area (temperatures at 10 M)	21
4.	Occurrence and abundance (standard haul totals) of sardine eggs by month and area, in hauls made during 1957	22
5.	Occurrence and abundance (standard haul totals) of sardine larvae, by month and area, in hauls made during 1957	29
6.	Occurrence and abundance (standard haul totals) of anchovy larvae (Engraulis mordax), by month and area, in hauls made during 1957	39
7.	Monthly abundance of anchovy larvae, 1953-1957, based on standard haul summations	40
8.	Abundance of anchovy larvae by size categories, 1953-1957, based on standard haul summations	40
9.	Occurrence and abundance (standard haul totals) of jack mackerel larvae (Trachurus symmetricus), by month and area, in hauls made during 1957	61
10.	Occurrence and abundance (standard haul totals) of Pacific mackerel larvae (Pneumatophorus diego), by month and area, in hauls made during 1957	74
11.	Occurrence and abundance (standard haul totals) of hake larvae (Merluccius productus), by month and area, in hauls made during 1957	80
12.	Occurrence and abundance (standard haul totals) of rockfish larvae (Sebastodes spp.), by month and area, in hauls made during 1957	90

TABLES

Nos.		Page
I.	Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957	9
II.	Record of sardine eggs, 1957	23
III.	Record of sardine larvae, 1957	30
IV.	Record of anchovy larvae, 1957	41
V.	Record of the larvae of jack mackerel (Trachurus symmetricus), 1957	63
VI.	Record of the larvae of Pacific mackerel (Pneumatophorus diego), 1957	75
VII.	Record of the larvae of hake (Merluccius productus), 1957)	81
VIII.	Record of the larvae of rockfish (Sebastodes spp.), 1957	91

ABSTRACT

This report contains the results of quantitative sampling of fish eggs and larvae off the coasts of California and Baja California during 1957 on cruises of the California Cooperative Oceanic Fisheries Investigations. It is the eighth in a continuing yearly series.

In addition to eggs and larvae of the Pacific sardine (Sardinops caerulea), larvae of the following are dealt with: northern anchovy (Engraulis mordax), jack mackerel (Trachurus symmetricus), Pacific mackerel (Pneumatophorus diego), hake (Merluccius productus), and rockfish (Sebastodes spp.). Larvae of all species except hake and rockfish are reported by size. The report includes charts showing distribution and relative abundance of the above species (except rockfish) and a brief discussion of each.

SARDINE EGGS AND LARVAE AND OTHER FISH LARVAE PACIFIC COAST, 1957

The first report in this series, which appeared as Special Scientific Report: Fisheries No. 80, contained a record of Pacific sardine or pilchard (Sardinops caerulea) eggs and larvae for 1950, and of larvae of the northern anchovy (Engraulis mordax), jack mackerel (Trachurus symmetricus), hake (Merluccius productus) and rockfish (Sebastodes spp.). Larvae of sardine and anchovy were reported by size; those of the other species by total number per station. The initial paper contained a more detailed account of methods of sampling and standardization of hauls than subsequent ones. The report has gradually evolved into its present format. A record of total number of larvae of Pacific mackerel (Pneumatophorus diego) per station was added to the report dealing with 1951 collections (Spec. Sci. Rept: Fisheries No. 102). Jack mackerel larvae were reported by size in the report for 1952 (Spec. Sci. Rept.: Fisheries No. 123) and subsequently. Pacific mackerel larvae were reported by size since 1953 (Spec. Sci. Rept.: Fisheries No. 155). Beginning with the report for 1955, yearly distribution charts were included for sardine eggs, and for larvae of sardine, anchovy, jack mackerel, Pacific mackerel, and hake; a series of summary tables (text tables) were added, along with a partial analysis of the data on distribution and abundance of each category. The present report is the eighth in a continuing series.

As in previous reports, the basic data are presented in eight tables, designated by Roman numerals:

I. Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957.
II. Record of sardine eggs, reported by age in days.
III. Record of all hauls containing sardine larvae, reported by size groups.
IV. Record of all hauls containing anchovy larvae, reported by size groups.
V. Record of all hauls containing jack mackerel larvae, reported by size groups.
VI. Record of all hauls containing Pacific mackerel larvae, reported by size groups.
VII. Hake larvae, reported by number per station.
VIII. Rockfish larvae, reported by number per station.

The fish eggs and larvae included in this report were obtained in quantitative plankton hauls on cruises of the California Cooperative Oceanic Fisheries Investigations. The investigations are sponsored by the California Marine Research Committee and are carried out cooperatively by the Biological Laboratory, La Jolla, of the U. S. Bureau of Commercial Fisheries, the Scripps Institution of Oceanography

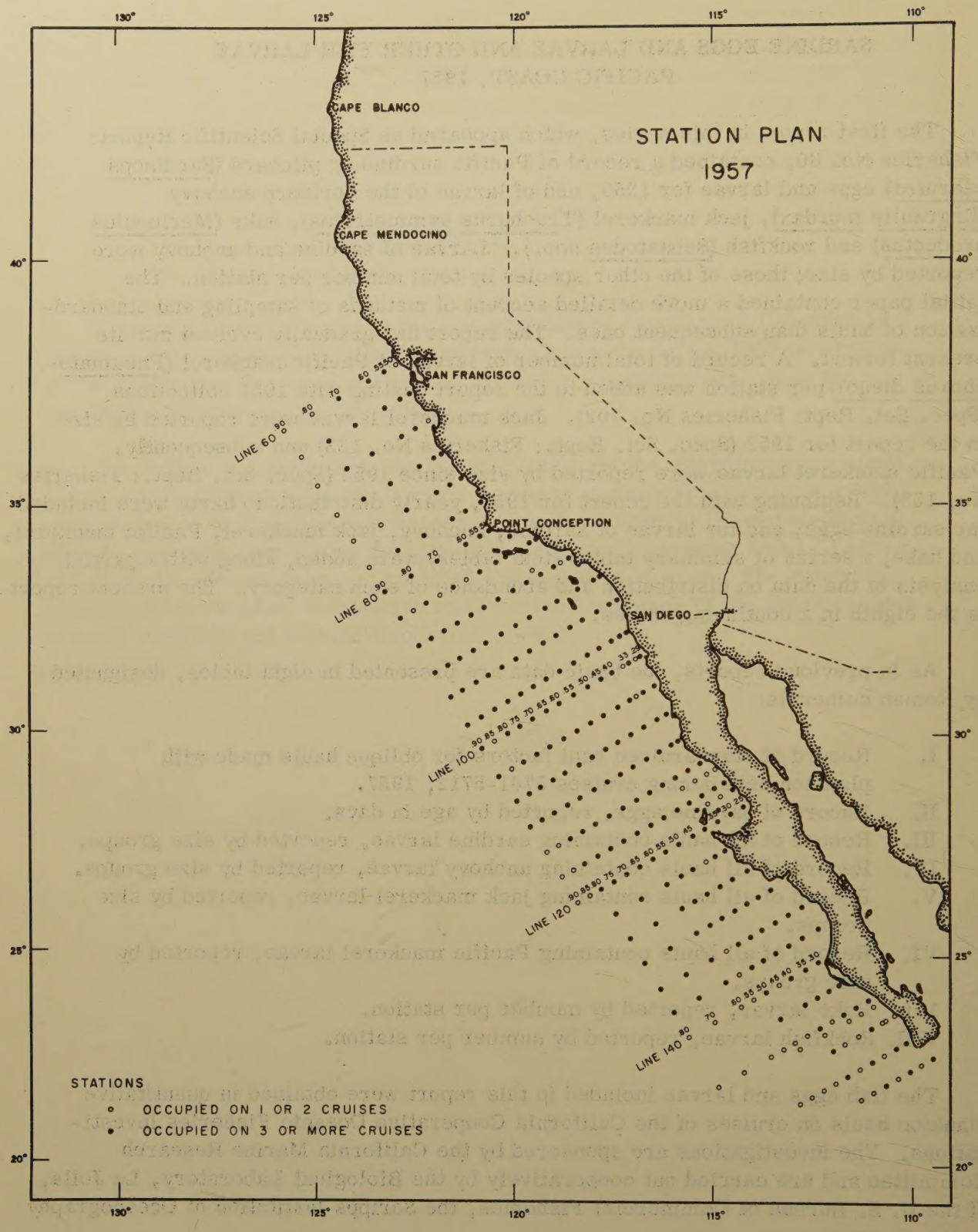


Figure 1.--Station plan, 1957, of the California Cooperative Oceanic Fisheries Investigations.

of the University of California, the Hopkins Marine Station of Stanford University, the California Department of Fish and Game, and the California Academy of Sciences. The biological-oceanographic cruises are a primary responsibility of the Scripps Institution of Oceanography and the Bureau of Commercial Fisheries.

It is with deep pleasure that I acknowledge the cooperation given by the Scripps Institution of Oceanography in the collection of data at sea. Most personnel of the Biological Laboratory, La Jolla, contributed to this project, many devoting their full time to it. Lois Hunter did most of the work of identifying, enumerating and measuring fish eggs and larvae in the 1957 material; James Thrailkill supervised the separation of fish eggs and larvae from plankton collections and also prepared the charts included in this report; standardization of egg and larval counts and preparation of the basic tables were done by Margaret Ahlstrom.

AREA COVERED, 1957

The area surveyed during 1957 is shown in figure 1. Stations occupied on three or more cruises are shown as black dots, those occupied on 1 or 2 cruises as open circles. The most extensive coverage was obtained during June, when the area surveyed extended from off San Francisco, California, (line 60) to below Cape San Lucas, Baja California, (line 157) and offshore to station 90 on many lines. The January cruise was an abbreviated one, because one of the two vessels scheduled to make the cruise was laid up for repairs. Extensive coverage was obtained on seven cruises - February through July and October (text table 1). The area off central Baja California only was surveyed during August and September, while the coverage during November and December was mostly confined to waters off southern California.

The Gulf of California was surveyed on four cruises during 1957 - in February, April, June, and August. Data from the Gulf cruises are not included in this report.

One to four vessels participated in each cruise. The "Black Douglas" made eight survey cruises (February through September). Five vessels of the Scripps Institution of Oceanography participated in one or more cruises, as follows: "Horizon", four cruises (February, April-June); "Spencer F. Baird", one cruise (February); "Stranger", seven cruises (April-August, October, December); "Orca", six cruises (January, March, May-July, November); "Paolina T", three cruises (July, October, December). Vessels making the Gulf of California cruises are given in the above listing, since these vessels occupied stations on lines 153 and 157 of the regular pattern in addition to the Gulf stations. The vessels used for Gulf of California cruises were as follows: February - "Spencer F. Baird", April - "Black Douglas", June - "Stranger", August - Stranger".

Text table 1.--Coverage during 1957

Month	Cruise number	Number vessels participating	Area covered	Number of stations occupied in each subarea						Total stations
				Lines 60-77	Lines 80-93	Lines 97-107	Lines 110-120	Lines 123-137	Lines 140-157	
January	5701	1	100-137	-	-	12	25	20	-	57
February	5702	3	80-157	-	35	27	31	25	24	142
March	5703	2	80-150	-	34	19	28	26	17	124
April	5704	3	80-157	-	41	38	39	43	46	207
May	5705	4	60-137	32	54	52	50	17	-	205
June	5706	4	60-157	36	57	51	56	30	23	253
July	5707	4	60-137	26	54	45	50	42	-	217
August	5708	2	110-137	-	-	-	23	14	-	37
			153-157	-	-	-	-	-	4	4
September	5709	1	110-137	-	-	-	23	14	-	37
October	5710	2	80-137	-	41	32	34	36	-	143
November	5711	1	70-97	7	30	7	-	-	-	44
December	5712	2	80-90(110)	-	18	4	1	-	-	23
Total			60-157	101	364	287	360	267	114	1,493

METHODS OF SAMPLING

Plankton nets used during 1957 were either constructed of No. 30xxx grit gauze, a heavy grade of silk bolting cloth, or No. 471 "Nitex", a nylon monofilament screen cloth. The mesh opening of Nitex cloth measures approximately 0.47 mm. The mesh opening of No. 30xxx grit gauze measures approximately 0.70 mm. before use, but soon shrinks to approximately 0.55 mm. between threads. Mesh openings in nets constructed of Nitex tend to enlarge slightly, hence the mesh openings of the two kinds of cloth, after use, are not too dissimilar.

The rapidity with which nylon cloth dries has proved to be a liability in plankton sampling. Unless a nylon net is very thoroughly washed after each use, any adhering plankton dries against and clings to the nylon threads, soon causing the nets to clog badly. Plankton nets are hosed down after each haul, but only scrubbed at intervals during a cruise. Silk nets, which dry more slowly and consequently remain damp between stations, do not develop this type of clogging problem.

Plankton hauls are made obliquely from approximately 140 meters deep to the surface (200 meters of wire out at greatest depth) where depth of water permits; at lesser depths in shallow water. The research vessel moves slowly ahead during a plankton haul, usually at a speed of between 1 and 2 knots. The amount of water strained during a haul is determined from the revolutions registered by a current meter fastened in the center of the mouth of the net.

ABUNDANCE OF FISH LARVAE IN 1957

Fish larvae were more abundant in 1957 than in the preceding two years, as is shown by the average number of larvae obtained per station (standardized counts):

Year	Number of stations occupied	Total number of larvae	Average per station
1955	1375	359,155	261
1956	1397	408,140	292
1957	1493	493,549	331

Text table 2. --Abundance (standard haul totals) of fish larvae in 1957, summarized by month

	Sardine	Anchovy	Jack mackerel	Pacific mackerel	Hake	Rockfish	All other fish larvae	Total
January	759	10,499	2	6	1,278	1,010	3,591	17,145
February	945	48,261	565	34	37,998	11,001	17,662	116,466
March	1,164	14,328	331	10	34,589	6,585	30,889	87,896
April	423	20,232	1,302	44	4,047	7,225	25,372	58,645
May	1,730	20,796	10,850	75	260	4,819	29,300	67,830
June	284	18,406	6,188	211	88	2,742	27,954	55,873
July	1,446	8,886	752	191	16	1,383	25,029	37,703
August	1,513	1,446	8	663	3	47	12,853	16,533
September	1,036	35	0	334	0	28	9,553	10,986
October	315	862	8	298	0	231	17,158	18,872
November	218	2,372	0	0	4	586	581	3,761
December	0	508	0	0	0	816	515	1,839
Total	9,833	146,631	20,006	1,866	78,283	36,473	200,457	493,549
Percent	2.0	29.7	4.1	0.4	15.8	7.4	40.6	100.0

The six kinds of larvae included in this report constituted over 59 percent of the fish larvae obtained in plankton hauls during 1957 (text table 2). As in all recent seasons, anchovy larvae were the most abundant kind in the survey area, and hake larvae were second in abundance. The abundance ranking of the other four kinds of larvae were as follows: fourth, rockfish larvae (Sebastodes spp.); sixth, jack mackerel larvae; eleventh, sardine larvae; and eighteenth, Pacific mackerel larvae.

The abundances (standard haul totals for the year)[1/] of the twelve most common kinds of larvae obtained in 1957 are compared with their contributions in 1956 and 1955:

Larvae	1957		1956		1955	
	Number	Rank	Number	Rank	Number	Rank
Anchovy (Engraulis mordax)	146,631	1	134,931	1	140,183	1
Hake (Merluccius productus)	78,283	2	94,277	2	60,090	2
Vinciguerria lucetia	55,114	3	9,832	9	12,654	9
Rockfish (Sebastodes spp.)	36,473	4	29,144	3	29,341	3
Leuroglossus stilbius	29,506	5	18,620	5	15,111	5
Jack mackerel (Trachurus symmetricus)	20,006	6	8,027	10	13,246	7
Lampanyctus leucopsarus	16,808	7	15,125	7	7,454	10
Lampanyctus mexicanus	16,207	8	10,802	8	13,165	8
Citharichthys spp.	15,813	9	23,635	4	20,411	4
Diogenichthys laternatus	11,603	10	3,158	13	4,771	11
Sardine (Sardinops caerulea)	9,833	11	15,523	6	14,121	6
Bathylagus wesethi	6,347	12	2,146	17	3,245	12
All others	50,925		42,920		25,363	
Total	493,549		408,140		359,155	

Monthly abundances of the larvae of sardine, anchovy, jack mackerel, Pacific mackerel, hake, and rockfish are summarized in text table 2.

1/ The method of deriving standard haul counts, totals and factors has been described by Ahlstrom (1948).

RECORD OF STANDARDIZED HAUL FACTORS FOR OBLIQUE HAULS MADE WITH PLANKTON NETS DURING CRUISES 5701-5712

Standardized haul factors are given for all plankton hauls taken in the regular CCOFI survey area during 1957, in table I. Hauls made in the Gulf of California are not included. Additional information concerning each haul, including position of occupancy, date and time of collection, volume of water strained, average depth of haul in meters, and volume of plankton obtained is given in Zooplankton volumes off the Pacific coast, 1957 (Thrailkill: in press).

The following symbols are used in table I:

(-) - a dash indicates that the station was not occupied on the cruise under which it appears.

NS - station occupied, but sample subsequently spoiled, broken or lost.

Table I

Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957

	Cruise and month											
Sta.	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
60.50	-	-	-	-	4.59	1.70	NQ	-	-	-	-	-
.55	-	-	-	-	4.85	3.03	3.38	-	-	-	-	-
.60	-	-	-	-	4.73	3.12	3.25	-	-	-	-	-
.70	-	-	-	-	4.52	2.84	4.51	-	-	-	-	-
.80	-	-	-	-	4.18	2.91	-	-	-	-	-	-
.90	-	-	-	-	4.35	4.02	-	-	-	-	-	-
63.52	-	-	-	-	4.36	3.72	2.64	-	-	-	-	-
.55	-	-	-	-	4.23	3.64	2.53	-	-	-	-	-
.60	-	-	-	-	3.32	3.24	3.57	-	-	-	-	-
.70	-	-	-	-	3.61	3.35	3.76	-	-	-	-	-
.80	-	-	-	-	3.87	3.65	2.26	-	-	-	-	-
.90	-	-	-	-	-	3.60	-	-	-	-	-	-
67.50	-	-	-	-	2.87	3.28	NS	-	-	-	-	-
.55	-	-	-	-	3.44	3.19	3.18	-	-	-	-	-
.60	-	-	-	-	3.52	3.50	3.34	-	-	-	-	-
.70	-	-	-	-	4.12	3.14	3.99	-	-	-	-	-
.80	-	-	-	-	4.00	3.19	3.23	-	-	-	-	-
.90	-	-	-	-	-	3.16	-	-	-	-	-	-
70.50	-	-	-	-	-	-	-	-	-	-	-	-
.52	-	-	-	-	3.52	3.71	3.12	-	-	-	-	-
.55	-	-	-	-	4.33	4.05	3.43	-	-	-	2.67	-
.60	-	-	-	-	4.30	3.13	3.54	-	-	-	3.06	-
.70	-	-	-	-	4.45	2.98	2.10	-	-	-	2.45	-
.80	-	-	-	-	3.47	3.19	-	-	-	-	3.11	-
.90	-	-	-	-	3.29	2.75	-	-	-	-	-	-
73.50	-	-	-	-	3.03	3.55	2.38	-	-	-	3.39	-
.55	-	-	-	-	3.11	3.86	3.42	-	-	-	3.17	-
.60	-	-	-	-	4.56	3.02	3.18	-	-	-	3.10	-
.70	-	-	-	-	4.13	3.10	3.72	-	-	-	-	-
.80	-	-	-	-	3.91	3.08	-	-	-	-	-	-
.90	-	-	-	-	-	3.44	-	-	-	-	-	-
77.50	-	-	-	-	3.30	3.06	3.30	-	-	-	-	-
.55	-	-	-	-	3.76	2.99	3.28	-	-	-	-	-
.60	-	-	-	-	4.02	3.20	3.58	-	-	-	-	-
.70	-	-	-	-	3.71	2.88	3.77	-	-	-	-	-
.80	-	-	-	-	3.69	2.83	3.65	-	-	-	-	-
.90	-	-	-	-	-	3.11	3.04	-	-	-	-	-

Table I (cont'd)

Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957

	Cruise and month											
Sta.	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
80.51	-	2.47	3.05	2.87	2.54	3.18	2.61	-	-	2.75	-	2.53
.55	-	2.97	2.95	1.86	2.69	3.44	2.83	-	-	2.95	3.06	3.00
.60	-	3.38	3.02	2.42	2.94	2.76	3.22	-	-	2.73	2.94	3.67
.70	-	2.73	2.76	3.23	3.57	3.29	3.73	-	-	2.90	2.81	3.32
.80	-	2.95	2.90	2.29	3.24	3.18	2.59	-	-	NS	-	3.01
.90	-	3.06	2.96	2.89	3.65	3.02	2.72	-	-	2.86	-	3.21
82.47	-	2.67	2.75	2.70	2.33	3.28	2.64	-	-	3.49	4.68	-
83.40	-	1.45	2.05	1.97	2.82	1.80	1.16	-	-	1.30	2.26	-
.43	-	2.99	2.83	1.65	2.52	2.62	1.07	-	-	3.55	5.65	-
.48	-	-	2.52	-	-	-	-	-	-	-	-	-
.51	-	4.52	-	2.41	3.45	3.55	2.43	-	-	3.05	3.32	-
.52	-	2.57	2.70	-	-	-	-	-	-	-	-	-
.55	-	-	-	-	3.40	3.37	2.85	-	-	-	2.30	-
.60	-	2.34	2.94	1.86	2.89	3.43	2.68	-	-	3.51	2.50	-
.65	-	-	-	-	-	3.15	3.28	-	-	-	-	-
.70	-	-	2.87	2.47	3.04	3.00	2.89	-	-	2.35	-	-
.75	-	-	-	-	-	2.60	3.55	-	-	-	-	-
.80	-	-	-	2.18	2.85	3.23	3.94	-	-	2.64	-	-
.85	-	-	-	-	-	2.93	2.78	-	-	-	-	-
.90	-	-	-	2.35	3.28	2.95	NS	-	-	2.63	-	3.01
86.46	-	4.09	-	2.46	-	-	-	-	-	-	-	-
87.35	-	2.67	3.01	2.07	2.96	3.38	2.58	-	-	2.86	2.25	-
.38	-	3.03	-	-	-	-	-	-	-	-	-	-
.40	-	3.06	2.76	2.43	2.19	4.04	NS	-	-	4.17	3.87	-
.45	-	-	3.12	-	3.48	4.08	2.69	-	-	3.09	3.49	-
.50	-	2.97	2.92	3.44	1.83	2.89	2.37	-	-	3.18	3.23	-
.55	-	2.54	-	-	3.25	2.84	2.86	-	-	2.39	2.59	-
.60	-	2.82	2.93	2.98	2.73	3.82	2.72	-	-	3.35	3.83	-
.65	-	-	-	-	2.89	2.77	3.40	-	-	-	-	-
.70	-	2.82	2.94	2.84	3.26	3.24	4.69	-	-	2.96	-	-
.75	-	-	-	-	3.35	2.95	3.82	-	-	-	-	-
.80	-	-	-	3.19	3.09	3.13	NS	-	-	3.21	-	-
.85	-	-	-	-	2.78	2.68	3.51	-	-	-	-	-
.90	-	-	-	2.52	3.45	3.01	3.49	-	-	2.74	-	3.15
90.28	-	2.74	2.25	2.37	2.68	3.97	2.00	-	-	3.27	5.53	3.30
.30	-	3.13	3.33	1.96	1.89	3.94	2.62	-	-	3.36	2.94	3.56
.37	-	2.62	3.01	3.10	3.17	3.19	2.43	-	-	3.35	1.93	2.99
.45	-	3.21	2.92	3.29	2.71	3.58	2.35	-	-	1.34	2.92	3.22

Table I (cont'd)

Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701–5712, 1957

	Cruise and month											
Sta.	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
90.50	–	–	–	–	2.77	3.59	2.09	–	–	1.36	2.30	3.86
.55	–	2.96	3.07	3.39	2.89	3.50	1.18	–	–	3.26	3.03	3.49
.60	–	2.91	2.85	2.93	3.42	3.15	2.34	–	–	3.35	3.37	3.28
.65	–	–	–	–	2.35	3.11	2.61	–	–	–	–	–
.70	–	3.08	2.80	2.90	3.30	3.14	2.74	–	–	3.15	–	3.09
.75	–	–	–	–	3.27	3.75	2.41	–	–	–	–	–
.80	–	2.89	2.86	3.10	2.57	3.27	2.57	–	–	1.34	–	2.79
.85	–	–	–	–	2.46	3.27	3.17	–	–	–	–	–
.90	–	2.81	3.16	3.31	3.02	3.35	2.64	–	–	3.11	–	3.27
93.27	–	2.87	2.96	3.14	2.25	3.70	2.12	–	–	2.85	2.80	–
.30	–	2.67	2.97	3.41	2.03	2.86	2.70	–	–	3.54	3.05	–
.35	–	–	–	3.67	2.08	3.08	2.61	–	–	4.47	2.32	–
.40	–	2.77	3.23	2.50	2.69	3.09	2.92	–	–	2.83	2.66	–
.45	–	–	–	3.09	2.63	3.14	2.22	–	–	–	3.09	–
.50	–	3.09	3.01	3.73	4.55	3.39	2.82	–	–	3.40	2.97	–
.55	–	–	–	2.40	2.90	3.28	3.00	–	–	–	2.54	–
.60	–	3.36	3.24	2.85	3.09	3.70	2.33	–	–	3.12	4.05	–
.65	–	–	–	–	2.56	3.67	2.23	–	–	–	–	–
.70	–	3.15	3.00	2.74	2.71	3.97	3.84	–	–	3.07	–	–
.75	–	–	–	–	2.68	3.48	3.58	–	–	–	–	–
.80	–	–	–	NS	2.70	3.52	2.59	–	–	3.17	–	–
.85	–	–	–	–	3.45	3.56	2.85	–	–	–	–	–
.90	–	–	–	1.59	2.99	3.84	2.46	–	–	3.44	–	–
97.30	–	2.67	2.53	1.53	2.23	3.26	1.99	–	–	2.12	4.21	–
.32	–	3.29	–	2.83	3.19	3.01	2.18	–	–	3.76	3.91	3.16
.35	–	–	–	–	–	–	–	–	–	3.49	–	–
.40	–	3.09	3.10	3.01	1.95	3.01	2.29	–	–	3.40	5.08	–
.45	–	–	–	3.07	2.60	4.03	2.73	–	–	–	3.70	–
.50	–	3.04	2.85	NS	2.87	3.77	2.66	–	–	3.51	1.96	–
.55	–	–	–	NS	3.24	3.29	2.86	–	–	–	2.65	–
.60	–	3.24	–	1.60	3.92	3.05	2.43	–	–	3.18	5.18	–
.65	–	–	–	–	2.90	3.54	2.58	–	–	–	–	–
.70	–	2.92	–	2.84	2.37	3.22	2.95	–	–	2.09	–	–
.75	–	–	–	–	3.35	3.11	2.85	–	–	–	–	–
.80	–	–	–	2.35	3.48	2.79	2.77	–	–	3.33	–	–
.85	–	–	–	–	2.98	3.03	2.82	–	–	–	–	–
.90	–	–	–	3.83	1.89	3.04	2.51	–	–	3.10	–	–

Table I (cont'd)
Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957

Sta.	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
100.29	-	2.98	3.49	2.62	2.26	2.97	1.89	-	-	3.15	-	-
.30	-	-	-	-	-	-	-	-	-	3.21	-	-
.33	-	2.80	3.42	2.61	2.13	2.99	2.82	-	-	-	-	-
.35	-	-	-	-	-	-	-	-	-	3.28	-	-
.40	-	2.80	3.06	2.45	3.70	3.90	2.65	-	-	2.85	-	2.95
.45	-	-	-	3.15	2.83	3.04	2.86	-	-	-	-	-
.50	-	2.78	3.18	3.14	2.40	2.99	2.79	-	-	3.00	-	-
.55	-	-	-	3.44	2.28	3.31	2.60	-	-	-	-	-
.60	2.97	3.41	3.00	2.42	2.98	3.10	2.72	-	-	3.17	-	-
.65	-	-	-	-	3.01	2.70	2.62	-	-	-	-	-
.70	-	3.62	-	1.76	3.42	2.80	-	-	-	2.84	-	-
.75	-	-	-	-	2.28	3.04	3.17	-	-	-	-	-
.80	-	3.43	-	3.41	2.17	3.52	-	-	-	2.99	-	-
.85	-	-	-	-	3.42	3.09	-	-	-	-	-	-
.90	-	3.70	-	2.66	3.20	2.81	-	-	-	3.09	-	-
103.30	2.45	3.40	2.93	1.43	2.26	2.77	1.63	-	-	2.62	-	-
.35	2.91	3.46	2.90	2.65	3.28	2.93	3.15	-	-	3.34	-	-
.38	2.91	3.28	-	-	-	-	-	-	-	-	-	-
.40	3.06	3.14	3.96	2.82	3.44	3.82	2.90	-	-	3.15	-	-
.45	-	-	-	3.08	2.56	3.87	2.83	-	-	-	-	-
.50	3.03	3.59	3.11	2.68	2.60	3.35	2.47	-	-	3.41	-	3.20
.55	-	-	-	2.80	3.57	3.27	2.56	-	-	-	-	-
.60	3.16	3.04	NS	3.41	3.47	3.36	2.67	-	-	3.20	-	-
.65	-	-	-	-	2.65	3.69	2.65	-	-	-	-	-
.70	-	3.23	3.10	3.20	3.21	3.29	3.07	-	-	3.34	-	-
.75	-	-	-	-	2.93	3.42	2.63	-	-	-	-	-
.80	-	-	-	3.01	3.43	3.28	-	-	-	3.05	-	-
.85	-	-	-	-	2.42	3.31	-	-	-	-	-	-
.90	-	-	-	3.13	2.70	3.00	-	-	-	-	-	-
107.32	2.91	1.49*	3.32	3.19	2.31	-	3.67	-	-	2.89	-	-
.35	2.90		3.21	3.25	2.10	3.40	3.49	-	-	2.60	-	-
.40	2.86	3.14	3.06	3.33	2.25	3.42	2.30	-	-	3.63	-	-
.45	-	-	-	2.84	3.02	3.35	3.21	-	-	-	-	-
.50	2.65	2.72	3.01	3.42	2.49	2.93	3.33	-	-	4.34	-	-
.55	-	-	-	3.18	2.14	3.13	3.23	-	-	-	-	-
.60	3.16	2.82	3.80	3.50	2.12	3.39	3.40	-	-	3.73	-	3.71
.65	-	-	-	-	3.02	3.27	3.36	-	-	-	-	-
.70	-	2.32	3.11	2.17	2.36	3.21	3.38	-	-	3.25	-	-

* - Samples combined. Values adjusted accordingly.

Table I (cont'd)
Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957

Sta.	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
107.75	-	-	-	-	2.12	3.08	3.25	-	-	-	-	-
.80	-	-	-	3.32	3.19	3.56	3.47	-	-	3.21	-	-
.85	-	-	-	-	3.56	3.19	3.47	-	-	-	-	-
.90	-	-	-	2.80	2.89	3.20	3.41	-	-	-	-	-
110.33	-	2.61	4.50	2.68	2.76	3.19	3.39	2.82	2.42	3.05	-	-
.35	-	3.09	3.51	3.14	2.96	3.11	2.96	2.90	3.54	2.45	-	-
.40	2.88	2.79	3.29	3.53	2.92	3.07	2.98	4.54	2.86	2.79	-	-
.45	-	-	-	2.99	3.07	3.03	3.24	-	-	-	-	-
.50	2.73	2.66	3.74	2.86	3.08	2.97	3.29	-	-	2.84	-	-
.55	-	-	-	2.96	3.16	2.61	3.30	-	-	-	-	-
.60	2.89	2.55	2.78	3.87	3.05	2.98	3.15	-	-	3.55	-	-
.65	-	-	-	-	2.66	2.53	4.33	-	-	-	-	-
.70	-	2.96	3.10	3.30	2.65	3.50	3.42	-	-	3.30	-	3.18
.75	-	-	-	-	2.89	3.24	3.70	-	-	-	-	-
.80	-	2.54	-	3.34	3.02	2.95	3.43	-	-	2.78	-	-
.85	-	-	-	-	2.78	2.14	3.32	-	-	-	-	-
.90	-	2.89	-	3.35	3.04	2.38	3.42	-	-	-	-	-
113.30	2.49	2.56	2.91	1.72	2.32	1.79	2.07	2.70	2.37	2.79	-	-
.35	2.72	2.50	3.17	3.95	3.10	2.69	3.95	2.66	3.13	3.24	-	-
.40	2.57	2.52	3.50	3.02	3.05	3.07	3.20	2.99	2.90	3.11	-	-
.45	-	-	-	2.83	2.74	3.22	3.33	-	-	-	-	-
.50	2.79	2.01	3.31	2.09	2.65	2.46	3.87	-	-	2.40	-	-
.55	-	-	-	3.18	2.92	2.88	3.50	-	-	-	-	-
.60	2.76	2.16	3.15	3.55	2.94	2.88	3.67	-	-	2.61	-	-
.65	-	-	-	-	2.71	2.39	3.43	-	-	-	-	-
.70	2.63	2.61	3.05	2.53	2.59	2.52	3.50	-	-	3.02	-	-
.75	-	-	-	-	2.56	2.54	3.33	-	-	-	-	-
.80	-	-	-	2.93	2.96	2.52	3.62	-	-	2.74	-	-
.85	-	-	-	-	-	2.93	-	-	-	-	-	-
.90	-	-	-	-	-	3.03	-	-	-	-	-	-
115.27	-	-	-	-	-	-	-	2.89	2.66	-	-	-
.30	-	-	-	-	-	-	-	3.38	3.09	-	-	-
.35	-	-	-	-	-	-	-	2.81	2.92	-	-	-
.40	-	-	-	-	-	-	-	3.07	3.21	-	-	-
117.26	2.58	2.36	3.28	2.83	1.67	1.50	3.40	2.92	2.65	3.01	-	-
.30	2.64	2.09	3.08	3.84	2.33	3.39	3.64	2.93	3.10	2.32	-	-
.35	2.67	1.54	3.45	1.89	2.07	2.45	3.79	3.20	3.00	2.40	-	-
.40	2.67	2.31	2.98	2.60	2.72	1.36	3.35	2.74	3.30	2.90	-	-

Table I (cont'd)

Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957

	Cruise and month											
Sta.	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
117.45	-	-	-	2.85	2.29	1.28	3.74	-	-	-	-	-
.50	2.64	2.81	3.12	2.71	2.80	3.13	3.34	-	-	3.10	-	-
.55	-	-	-	3.11	3.04	2.58	3.01	-	-	-	-	-
.60	2.70	2.42	3.07	2.63	3.08	2.46	2.96	-	-	2.04	-	-
.65	-	-	-	-	2.61	2.38	3.68	-	-	-	-	-
.70	2.77	4.03	3.21	2.67	2.27	2.46	3.30	-	-	2.24	-	-
.75	-	-	-	-	2.69	2.82	3.37	-	-	-	-	-
.80	-	-	-	2.42	2.68	3.46	3.64	-	-	2.46	-	-
.85	-	-	-	-	-	3.33	-	-	-	-	-	-
.90	-	-	-	-	-	3.21	-	-	-	-	-	-
118.39	-	-	2.39	2.15	3.02	2.41	3.29	-	-	2.38	-	-
118^{5}25	-	-	-	-	-	-	-	3.02	2.54	-	-	-
118^{5}30	-	-	-	-	-	-	-	3.19	3.75	-	-	-
118^{5}35	-	-	-	-	-	-	-	3.12	3.48	-	-	-
119.33	-	-	3.24	3.08	2.68	2.74	3.43	2.90	2.98	2.60	-	-
120.25	2.27	2.98	2.98	2.45	3.70	2.52	2.97	2.96	3.17	2.52	-	-
.30	2.46	2.93	3.01	2.14	2.79	3.30	3.23	3.34	3.09	2.11	-	-
.35	2.33	2.43	2.27	1.90	3.00	1.71	2.87	2.13	2.99	2.27	-	-
.40	1.25	2.35	1.87	-	1.52	1.79	1.89	2.03	2.95	1.67	-	-
.45	2.78	2.77	-	-	2.53	3.21	3.85	2.93	2.82	2.80	-	-
.50	2.72	2.76	-	2.89	2.60	2.53	3.65	-	-	2.72	-	-
.55	2.79	2.35	-	2.65	2.79	2.26	3.34	-	-	-	-	-
.60	2.64	3.16	2.86	3.35	2.91	3.68	3.52	-	-	3.01	-	-
.65	-	-	-	-	3.03	3.43	3.54	-	-	-	-	-
.70	2.95	3.01	3.73	2.45	2.94	2.87	3.36	-	-	3.26	-	-
.75	-	-	-	-	2.50	3.49	3.40	-	-	-	-	-
.80	-	2.45	3.25	3.05	2.51	2.31	3.48	-	-	2.93	-	-
.85	-	-	-	-	-	2.82	-	-	-	-	-	-
.90	-	-	-	-	-	3.05	-	-	-	2.97	-	-
123.37	2.46	1.70	3.24	2.97	1.96	2.16	2.90	2.43	3.37	2.72	-	-
.42	2.77	2.67	2.99	2.88	2.70	3.08	3.13	3.30	3.17	2.93	-	-
.45	-	-	-	-	-	-	-	3.03	3.23	-	-	-
.50	2.84	2.38	3.00	2.49	-	3.17	2.91	-	-	2.54	-	-
.55	-	2.27	2.89	2.59	-	2.73	3.09	-	-	-	-	-
.60	2.72	2.22	2.83	3.05	-	2.98	3.09	-	-	3.06	-	-
.70	-	-	-	2.07	-	-	3.30	-	-	3.09	-	-
.80	-	-	-	2.46	-	-	3.00	-	-	2.95	-	-

Table I (cont'd)
Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957

Sta.	Cruise and month 5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
127.34	2.44	2.63	3.05	1.63	2.91	2.18	2.15	2.88	3.37	3.39	-	-
.40	2.73	3.52	3.75	2.73	2.73	2.77	3.05	3.36	3.46	3.78	-	-
.45	-	2.51	2.74	3.04	3.57	2.77	3.24	2.85	3.78	3.82	-	-
.50	2.63	2.64	3.15	2.64	-	2.88	3.12	-	-	4.34	-	-
.55	-	3.46	3.37	2.98	-	2.32	3.23	-	-	-	-	-
.60	2.82	2.67	3.41	3.01	-	2.78	2.90	-	-	3.25	-	-
.70	-	-	-	3.05	-	-	3.53	-	-	3.08	-	-
.80	-	-	-	2.74	-	-	3.17	-	-	3.61	-	-
130.30	2.39	1.60	2.67	1.74	2.94	2.59	2.59	2.68	2.57	3.35	-	-
.35	2.64	2.18	3.11	2.10	2.42	3.10	2.76	2.97	3.13	4.28	-	-
.40	2.89	2.61	2.69	2.83	2.19	3.13	3.30	2.75	3.30	5.25	-	-
.45	-	-	-	2.97	-	2.98	2.95	2.70	4.54	-	-	-
.50	2.83	2.98	3.41	3.06	2.77	3.33	3.08	-	-	3.31	-	-
.55	-	-	-	3.28	-	2.97	2.79	-	-	-	-	-
.60	2.87	2.62	3.05	3.07	2.74	3.04	3.48	-	-	3.41	-	-
.70	-	-	-	2.51	-	-	2.95	-	-	2.99	-	-
.80	-	-	-	2.87	-	-	3.63	-	-	3.87	-	-
133.25	2.63	1.38	2.56	2.52	2.33	3.20	2.72	3.24	3.01	3.02	-	-
.30	2.64	2.37	2.73	2.42	2.32	3.41	3.33	3.46	3.53	2.73	-	-
.35	2.81	-	3.22	2.98	-	2.38	3.42	-	-	3.30	-	-
.40	2.67	2.11	2.87	2.97	2.65	2.66	3.43	-	-	3.05	-	-
.45	-	-	-	2.78	-	2.10	3.61	-	-	-	-	-
.50	-	3.18	3.24	3.17	3.14	3.36	3.38	-	-	3.09	-	-
.55	-	-	-	2.89	-	-	-	-	-	-	-	-
.60	-	-	-	2.19	-	-	3.12	-	-	2.93	-	-
.70	-	-	-	2.90	-	-	3.20	-	-	2.82	-	-
.80	-	-	-	2.15	-	-	3.13	-	-	4.07	-	-
137.23	2.43	2.13	2.86	1.65	2.81	2.62	2.71	2.67	3.22	3.63	-	-
.30	2.85	2.49	2.79	3.30	2.79	2.63	3.45	3.03	3.29	3.71	-	-
.35	2.67	2.46	2.92	-	-	2.45	3.56	-	-	3.65	-	-
.40	-	2.20	2.91	2.38	NS	2.53	3.74	-	-	3.15	-	-
.45	-	-	-	2.39	-	2.09	3.30	-	-	-	-	-
.50	-	2.38	3.15	2.93	2.42	3.25	3.30	-	-	2.92	-	-
.55	-	-	-	2.89	-	-	-	-	-	-	-	-
.60	-	-	-	2.77	-	-	3.06	-	-	3.09	-	-
.70	-	-	-	3.14	-	-	3.16	-	-	3.25	-	-
.80	-	-	-	3.20	-	-	2.86	-	-	3.14	-	-

Table I (cont'd)

Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957

	Cruise and month											
Sta.	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
140.30	-	2.05	2.70	2.35	-	2.17	-	-	-	-	-	-
.35	-	1.83	2.75	2.53	-	3.34	-	-	-	-	-	-
.40	-	2.85	3.18	2.04	-	2.78	-	-	-	-	-	-
.45	-	-	-	2.28	-	-	-	-	-	-	-	-
.50	-	3.37	2.90	2.51	-	3.83	-	-	-	-	-	-
.55	-	-	-	2.56	-	-	-	-	-	-	-	-
.60	-	-	-	2.99	-	-	-	-	-	-	-	-
.70	-	-	-	2.86	-	-	-	-	-	-	-	-
.80	-	-	-	2.48	-	-	-	-	-	-	-	-
143.26	-	2.07	2.94	2.61	-	-	-	-	-	-	-	-
.30	-	2.39	3.31	2.48	-	4.31	-	-	-	-	-	-
.35	-	2.08	2.44	2.52	-	3.89	-	-	-	-	-	-
.40	-	2.86	3.07	2.86	-	3.77	-	-	-	-	-	-
.50	-	3.01	3.13	-	-	3.52	-	-	-	-	-	-
147.20	-	3.09	3.13	2.99	-	-	-	-	-	-	-	-
.25	-	3.63	2.59	2.88	-	-	-	-	-	-	-	-
.30	-	2.87	2.90	2.98	-	-	-	-	-	-	-	-
.35	-	-	-	2.85	-	-	-	-	-	-	-	-
.40	-	2.26	3.01	2.46	-	-	-	-	-	-	-	-
.45	-	-	-	2.59	-	-	-	-	-	-	-	-
.50	-	-	-	3.02	-	-	-	-	-	-	-	-
.55	-	-	-	3.41	-	-	-	-	-	-	-	-
.60	-	-	-	2.41	-	-	-	-	-	-	-	-
.70	-	-	-	2.80	-	-	-	-	-	-	-	-
.80	-	-	-	2.89	-	-	-	-	-	-	-	-
148.20	-	-	-	-	-	2.91	-	-	-	-	-	-
.25	-	-	-	-	-	3.65	-	-	-	-	-	-
.30	-	-	-	-	-	3.47	-	-	-	-	-	-
.40	-	-	-	-	-	3.03	-	-	-	-	-	-
.50	-	-	-	-	-	3.32	-	-	-	-	-	-
150.16	-	-	-	2.89	-	-	-	-	-	-	-	-
.19	-	2.07	2.31	-	-	-	-	-	-	-	-	-
.20	-	-	-	2.97	-	-	-	-	-	-	-	-
.25	-	3.08	2.81	2.69	-	-	-	-	-	-	-	-
.30	-	-	2.52	2.87	-	-	-	-	-	-	-	-
.35	-	3.38	-	2.77	-	-	-	-	-	-	-	-
.40	-	2.29	2.10	3.24	-	-	-	-	-	-	-	-

Table I (cont'd)
Record of standardized haul factors for oblique hauls made with plankton nets during cruises 5701-5712, 1957

Sta.	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
153.16	-	1.84	-	2.47	-	2.98	-	2.78	-	-	-	-
.20	-	3.40	-	3.31	-	2.98	-	3.25	-	-	-	-
.25	-	-	-	2.17	-	2.46	-	-	-	-	-	-
.30	-	3.01	-	3.11	-	2.02	-	-	-	-	-	-
.35	-	-	-	2.40	-	-	-	-	-	-	-	-
.40	-	2.25	-	1.92	-	2.58	-	-	-	-	-	-
.45	-	-	-	2.72	-	-	-	-	-	-	-	-
.50	-	-	-	2.99	-	-	-	-	-	-	-	-
.55	-	-	-	2.53	-	-	-	-	-	-	-	-
.60	-	-	-	2.15	-	-	-	-	-	-	-	-
157.10	-	1.13	-	-	-	-	-	-	-	-	-	-
.15	-	-	-	2.79	-	3.32	-	2.97	-	-	-	-
.20	-	3.51	-	2.74	-	2.78	-	2.38	-	-	-	-
.25	-	-	-	2.86	-	2.77	-	-	-	-	-	-
.30	-	2.94	-	2.72	-	2.90	-	-	-	-	-	-
.35	-	-	-	2.69	-	-	-	-	-	-	-	-
.40	-	-	-	2.80	-	2.57	-	-	-	-	-	-

A listing of all hauls containing sardine eggs in the 1957 plankton samples obtained on CCOFI cruises is contained in table II. The eggs at each station are reported by age in days (A to D; see below) for two categories, normal and total. Abnormal eggs have embryos that are stunted and misshapen, either due to mechanical injury during collection (rupture of the vitelline membrane) or to a diseased condition of the eggs. Deteriorating eggs are eggs in such poor condition that they cannot be classified with certainty.

The age categories into which sardine eggs are separated are the following:

A - Eggs spawned within 24 hours of collection
B - Eggs spawned within 24.1 to 48 hours of collection
C - Eggs spawned within 48.1 to 72 hours of collection
D - Eggs spawned within 72.1 to 96 hours of collection
Unclassified (Uncl.) - deteriorating eggs that cannot be aged with certainty.

A dash (-) in table II indicates that the category was not represented at a station, either actually or potentially.

Considerable publicity has been given to the warming that occurred in the CCOFI area during 1957 and which has continued to the time of writing this report - May 1959 (Progress Report, 1 July 1956 to 1 January 1958, California Cooperative Oceanic Fisheries Investigations, sponsored by the State of California Marine Research Committee, pp. 7-26). The temperatures at which sardine eggs were obtained during 1957 are given by month and area in text table 3. A comparison with average "spawning" temperatures by area for the preceding six years (1951-1956) follows:

Area	1957 season: Number of observations	1957 season: Average temperature	Average temperature (1951-1956)	Difference
60-77 (complete season)	3	13.4	-	-
80-93 (complete season)	16	15.0	14.7	+0.3
97-107 (complete season)	15	15.4	15.1	+0.3
110-120 (main spawning period)	11	16.4	15.4	+1.0
(late season spawning)	16	20.8	18.1	+2.7
123-137 (main spawning period)	8	16.6	15.7	+1.1
(late season spawning)	6	21.0	18.0	+3.0
140-157 (complete season)	0	-	18.7	

In the northern half of the spawning area (lines 80-107) in 1957, sardine eggs were obtained at temperatures which averaged only 0.3° C higher than during the previous six years. In the southern half of the spawning area (lines 110-137), water temperatures at the stations having sardine eggs averaged a full degree higher during the main spawning period (January through June), and 2.7° C to 3.0° C higher during the late spawning period (July through October). Hence, the increased water temperatures during 1957 were reflected mainly in the southern half of the spawning distribution.

The distribution and relative abundance of sardine eggs in 1957 are illustrated in figure 2. The abundance shown for each station represents the cumulative standard haul total of sardine eggs at the station during the year. Stations (open circles) without shading had no sardine eggs in the plankton hauls taken during the year.

Occurrences and abundance (standard haul totals) of sardine eggs are summarized by month and area in text table 4. Sardine eggs were taken in fewer hauls than in any recent year; occurrences during 1957 numbered 76, as compared to 144 in 1956, 186 in 1955, and 309 in 1954. The decrease in occurrences in 1957 reflects, in part at least, a decrease in abundance of spawning sardines. Coverage of spawning areas was as thorough in 1957 as in preceding years, except 1954. (Coverage in 1954 was more intensive than at any time before or since.)

The distribution of spawning between the several subareas, however, has been fairly similar during the past three seasons. This is shown in the following summary:

	1955			1956			1957		
Station lines	Occurrences	Number	Percent	Occurrences	Number	Percent	Occurrences	Number	Percent
60-77	0	0	0	0	0	0	3	201	0.6
80-93	39	6,007	13.3	29	11,739	11.9	16	5,914	18.9
97-107	69	16,156	35.7	53	34,043	34.6	15	8,883	28.4
110-120	60	18,763	41.4	47	41,969	42.7	28	12,723	40.7
123-137	13	3,963	8.8	13	10,532	10.7	14	3,552	11.4
140-157	5	309	0.7	2	44	0.1	0	0	0
Total	186	45,198	99.9	144	98,327	100.0	76	31,273	100.0

It is convenient to divide sardine spawning into two major centers: one off southern California and northern Baja California (station lines 80-107), the other off central Baja California (station lines 110-137). The two centers have been of about equal importance in each of the above seasons. In 1955, 49 percent of the eggs were obtained in the northern center; in 1956 the percentage was 46 percent; in 1957 it was 48 percent.

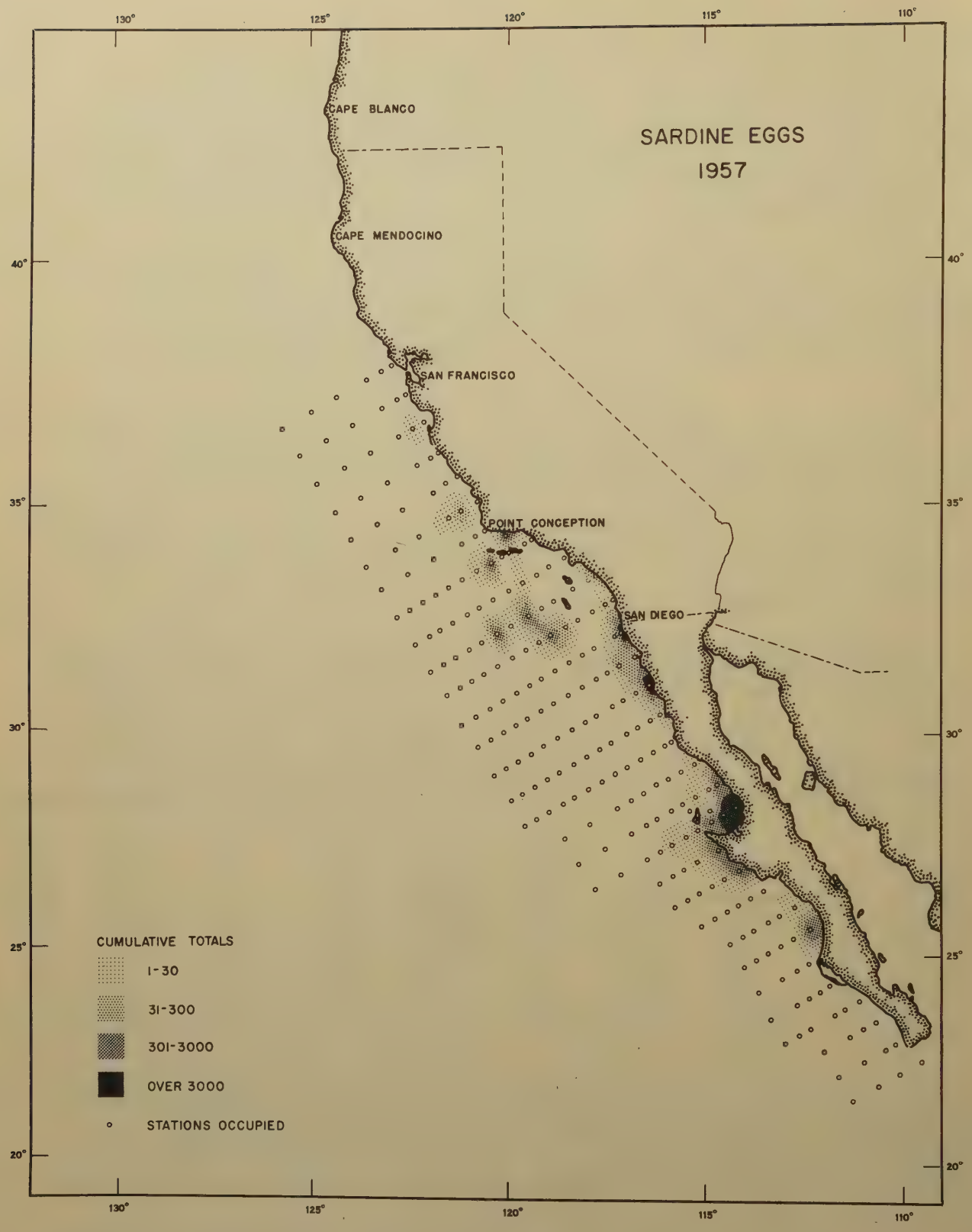


Figure 2.--Sardine eggs, 1957: Distribution and relative abundance.

Text table 3.--Temperature ranges and means for stations containing sardine eggs in 1957, summarized by month and area (temperatures at 10 M)

Southern California (lines 80-93)			
Cruise number	Number of observations	Temperature range	Mean temperature
5703	2	12.41-13.24 °C	12.83 °C
5704	3	13.00-14.76	14.06
5705	6	14.35-16.30	15.36
5706	3	15.06-17.83	16.16
5707	1	15.96	15.96
5711	1	15.68	15.68
Total	16	12.41-17.83	15.01

Northern Baja California (lines 97-107)			
Cruise number	Number of observations	Temperature range	Mean temperature
5702	1	14.46 °C	14.46 °C
5703	5	13.50-15.47	14.15
5704	3	12.72-15.42	14.38
5705	3	15.56-16.74	16.09
5706	0	-	-
5707	3	16.62-20.11	18.02
Total	15	12.72-20.11	15.38

Upper central Baja California (lines 110-120)			
Cruise number	Number of observations	Temperature range	Mean temperature
Main spawning period:			
5701	2	16.73-17.00 °C	16.86 °C
5702	2	16.07-16.72	16.40
5703	3	14.78-15.72	15.24
5704	0	-	-
5705	2	15.58-16.88	16.23
5706	2	17.22-18.06	17.64
Total	11	14.78-18.06	16.36
Late spawning period:			
5707	4	17.84-21.15	20.10
5708	4	21.08-22.50	21.98
5709	4	16.61-22.40	20.57
5710	4	19.86-21.02	20.67
Total	16	17.84-22.50	20.83

Lower central Baja California (lines 123-137)			
Cruise number	Number of observations	Temperature range	Mean temperature
5701	1	18.66 °C	18.66 °C
5702	2	18.02-18.27	18.14
5703	1	15.35	15.35
5704	1	15.72	15.72
5705	3	14.94-16.46	15.52
5706	0	-	-
Total	8	14.94-18.66	16.57
5707	1	16.54	16.54
5708	3	20.10-24.88	22.23
5709	1	21.68	21.68
5710	1	20.64	20.64
Total	6	16.54-24.88	20.98

Text table 4.--Occurrence and abundance (standard haul totals) of sardine eggs, by month and area, in hauls made during 1957

Cruise	Central California 60-77		Southern California 80-93		Northern Baja California 97-107		Upper central Baja California 110-120		Lower central Baja California 123-137		Southern Baja California 140-157		Total	
	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber
5701	-	-	-	-	0	0	2	17	1	12	-	-	3	29
5702	-	-	0	0	1	4,977	2	18	2	155	0	0	5	5,150
5703	-	-	2	15	5	386	3	88	1	3	0	0	11	492
5704	-	-	3	1,073	3	617	0	0	1	12	0	0	7	1,702
5705	0	0	6	2,015	3	2,757	2	74	3	1,703	-	-	14	6,549
5706	3	201	3	729	0	0	2	5	0	0	0	0	8	935
5707	0	0	1	1,824	3	146	4	7,807	1	47	-	-	9	9,824
5708	-	-	-	-	-	-	5	797	3	1,349	-	-	8	2,146
5709	-	-	-	-	-	-	4	3,668	1	263	-	-	5	3,931
5710	-	-	0	0	0	0	4	249	1	8	-	-	5	257
5711	0	0	1	258	0	0	-	-	-	-	-	-	1	258
5712	-	-	0	0	-	-	-	-	-	-	-	-	0	0
Total	3	201	16	5,914	15	8,883	28	12,723	14	3,552	0	0	76	31,273
Percent		0.64		18.91		28.40		40.68		11.36		0		99.99

Table II

Record of sardine eggs, 1957

Station	Number of normal eggs A	B	C	D	Total number of eggs A	B	C	D	Uncl.	n
Cruise 5701:										
117.26	0	3	5	-	0	3	5	-	0	8
120.25	9	0	0	-	9	0	0	-	0	9
123.37	0	12	-	-	0	12	-	-	0	12
Total	9	15	5	-	9	15	5	-	0	29
Cruise 5702:										
103.30	190	2,353	1,333	-	380	2,924	1,673	-	0	4,977
120.25	0	6	6	-	0	6	6	-	0	12
120.40	0	2	0	-	0	4	0	-	2	6
123.37	76	8	-	-	113	10	-	-	0	123
127.34	0	32	-	-	0	32	-	-	0	32
Total	266	2,401	1,339	-	493	2,976	1,679	-	2	5,150
Cruise 5703:										
83.48	0	0	0	0	0	5	2	0	2	9
90.60	0	0	0	0	0	0	6	0	0	6
97.30	15	40	46	-	35	40	66	-	0	141
100.29	0	0	4	0	0	0	4	0	4	8
103.30	0	23	176	20	0	26	182	23	0	231
103.35	0	3	-	-	0	3	-	-	0	3
107.32	3	0	0	-	3	0	0	-	0	3
117.30	0	0	0	9	0	0	0	9	3	12
117.35	0	0	28	-	0	0	28	-	0	28
120.25	0	42	-	-	6	42	-	-	0	48
127.34	0	0	3	-	0	0	3	-	0	3
Total	18	108	257	29	44	116	291	32	9	492
Cruise 5704:										
90.55	0	27	0	-	0	27	0	-	0	27
93.45	0	0	49	-	0	0	61	-	0	61
93.50	104	254	313	-	164	284	522	-	15	985
97.30	104	0	-	-	309	0	-	-	0	309
100.29	0	16	52	0	0	79	83	5	0	167
103.30	0	46	1	-	0	133	8	-	0	141
123.42	0	0	12	-	0	0	12	-	0	12
Total	208	343	427	0	473	523	686	5	15	1,702

Table II (cont'd)
Record of sardine eggs, 1957

Station	Number of normal eggs A	B	C	D	Total number of eggs A	B	C	D	Uncl.	n
Cruise 5705:										
83.55	0	496	592	-	0	686	803	-	68	1,557
83.60	0	0	0	-	0	3	12	-	0	15
87.50	2	0	-	-	2	0	-	-	0	2
90.28	38	5	0	-	102	5	0	-	0	107
90.55	92	92	-	-	138	184	-	-	0	322
93.30	0	0	4	-	0	0	12	-	0	12
97.30	0	424	27	-	0	1,191	874	-	593	2,658
97.32	0	0	19	-	0	0	22	-	0	22
100.33	0	0	34	-	0	0	77	-	0	77
120.25	22	41	-	-	26	41	-	-	4	71
120.50	0	0	0	-	0	0	3	-	0	3
127.34	0	9	87	-	0	15	151	-	0	166
133.25	0	9	0	-	0	9	0	-	0	9
137.23	315	112	0	-	1,304	224	0	-	0	1,528
Total	469	1,188	763	-	1,572	2,358	1,954	-	665	6,549
Cruise 5706:										
67.55	0	0	0	6	0	0	0	6	0	6
77.55	0	24	87	57	12	27	90	60	0	189
77.60	0	0	6	-	0	0	6	-	0	6
90.65	227	68	3	-	603	87	6	-	0	696
93.27	0	0	-	-	7	0	-	-	0	7
93.55	7	3	3	-	20	3	3	-	0	26
120.25	0	2	-	-	0	2	-	-	0	2
120.45	0	0	-	-	0	3	-	-	0	3
Total	234	97	99	63	642	122	105	66	0	935
Cruise 5707:										
82.47	3	1,750	-	-	3	1,821	-	-	0	1,824
97.30	22	8	-	-	76	24	-	-	2	102
103.30	0	3	11	-	0	3	27	-	0	30
107.32	0	7	-	-	0	14	-	-	0	14
117.26	422	119	-	-	589	136	-	-	0	725
120.25	1,307	1,782	-	-	1,485	1,907	-	-	0	3,392
120.30	472	2,862	-	-	562	2,956	-	-	0	3,518
120.40	0	146	-	-	0	172	-	-	0	172
123.37	9	38	-	-	9	38	-	-	0	47
Tota.	2,235	6,715	11	-	2,724	7,071	27	-	2	9,824

Table II (cont'd)
Record of sardine eggs, 1957

Station	Number of normal eggs A	B	C	D	Total number of eggs A	B	C	D	Uncl.	n
Cruise 5708:										
113.30	0	8	-	-	0	8	-	-	0	8
120.25	477	-	-	-	524	-	-	-	0	524
120.30	0	57	-	-	0	77	-	-	0	77
120.35	2	87	-	-	4	119	-	-	2	125
120.40	6	49	-	-	12	51	-	-	0	63
123.37	54	-	-	-	103	-	-	-	2	105
127.34	0	881	-	-	0	1,241	-	-	0	1,241
127.40	0	0	-	-	0	3	-	-	0	3
Total	539	1,082	-	-	643	1,499	-	-	4	2,146
Cruise 5709:										
113.30	0	2	-	-	0	2	-	-	0	2
120.25	653	-	-	-	1,373	-	-	-	0	1,373
120.30	241	-	-	-	420	-	-	-	22	442
120.35	724	-	-	-	1,851	-	-	-	0	1,851
123.37	111	-	-	-	256	-	-	-	7	263
Total	1,729	2	-	-	3,900	2	-	-	29	3,931
Cruise 5710:										
119.33	0	10	-	-	0	10	-	-	0	10
120.25	44	70	-	-	70	134	-	-	0	204
120.30	6	0	-	-	6	0	-	-	6	12
120.35	23	-	-	-	23	-	-	-	0	23
123.37	8	-	-	-	8	-	-	-	0	8
Total	81	80	-	-	107	144	-	-	6	257
Cruise 5711:										
83.55	5	0	-	-	14	244	-	-	0	258
Total	5	0	-	-	14	244	-	-	0	258
Cruise 5712:										0

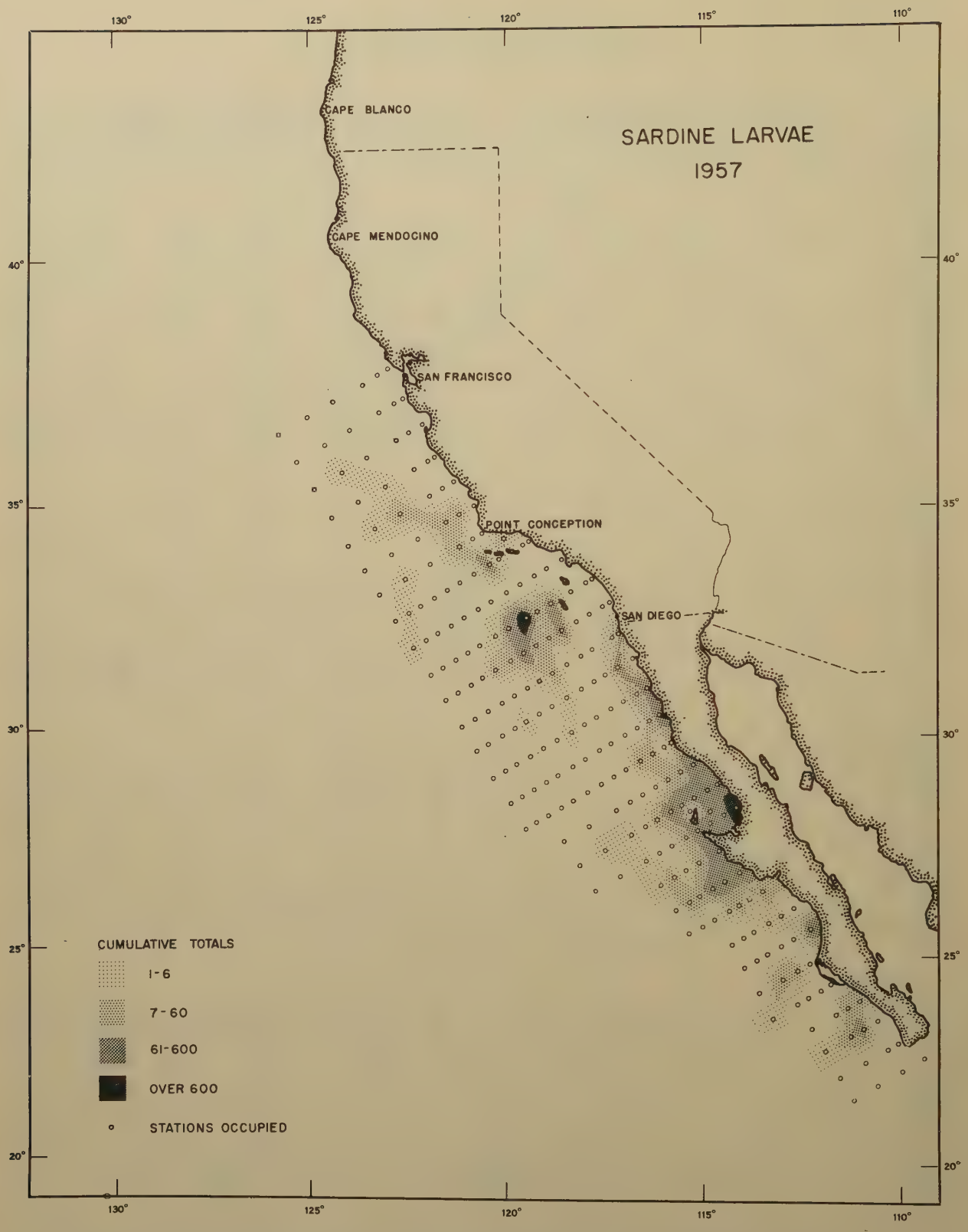


Figure 3.--Sardine larvae, 1957: Distribution and relative abundance.

Sardine larvae are grouped by size classes in table III, which have the following midpoints and ranges:

Midpoint (in mm.)	Range (in mm.)	Midpoint (in mm.)	Range (in mm.)
3.00	2.00-4.25	12.75	12.26-13.25
4.75	4.26-5.25	13.75	13.26-14.25
5.75	5.26-6.25	14.75	14.26-15.25
6.75	6.26-7.25	15.75	15.26-16.25
7.75	7.26-8.25	17.25	16.26-18.25
8.75	8.26-9.25	19.25	18.26-20.25
9.75	9.26-10.25	21.25	20.26-22.25
10.75	10.26-11.25	23.25	22.26-24.25
11.75	11.26-12.25	25.25	24.26-26.25

Dis. - Disintegrating larvae that cannot be measured accurately.

The distribution of sardine larvae in 1957 is illustrated in figure 3. Stations occupied during the year are shown as open circles. Four categories of abundance (other than 0) are used. The value shown for a station is the cumulative standard haul total of sardine larvae taken in all occupancies during the year.

There were considerably more hauls containing sardine larvae in 1957 than eggs: 175, as compared to 76. The distribution of catches of eggs and larvae is summarized by area in the following table:

	Sardine eggs			Sardine larvae		
Station lines	occur-rences	num-ber	percent	occur-rences	num-ber	percent
60-77 (complete season)	3	201	0.6	6	94	1.0
80-93 (complete season)	16	5,914	18.9	21	2,028	20.6
97-107 (complete season)	15	8,883	28.4	22	757	7.7
110-120 (Jan.-June)	11	202	0.6	35	1,364	13.9
(July-Oct.)	17	12,521	40.0	48	3,889	39.6
123-137 (Jan.-June)	8	1,885	6.0	21	957	9.7
(July-Oct.)	6	1,667	5.3	10	316	3.2
140-157 (complete season)	0			12	428	4.3
Total	76	31,273	99.8	175	9,833	100.0

As has been noted in previous reports, the center of distribution of sardine larvae tends to be somewhat south of the distribution of eggs, due to the predominantly southward transport of eggs and larvae. Off California and northern Baja California (lines 60-107) there were 49 occurrences of larvae to 34 of eggs, or a ratio of occurrences of larvae to eggs of 1.4. Off central Baja California (lines 110-137) there were 114 occurrences of larvae to 42 occurrences of eggs, or a ratio of 2.7 occurrences of larvae to each occurrence of eggs. Only larvae were obtained off southern Baja California (lines 140-157).

The temporal distributions of eggs and larvae agree quite well. In the northern part of the range (lines 60-77), eggs were obtained in June, larvae in June and July (text table 5). Off southern California, eggs were obtained during March through July and in October; larvae were taken in April through July and October; off northern Baja California (lines 97-107) eggs and larvae were taken during February through July; off central Baja California eggs and larvae were taken throughout the period of sampling.

Larger sardine larvae (i.e., larvae 12.26 mm. and larger) were markedly more abundant in the southern part of the distribution. In fact, larger larvae were taken in the northern half of the spawning distribution (lines 60-107) only during June and July, but were taken on all cruises off central and southern Baja California except May and July. The larger larvae occurred in greatest abundance in February and September.

Larger sardine larvae (standard haul totals)

	California and northern Baja California (lines 60-107)			Central and southern Baja California (lines 110-157)		
	12.26-15.25 mm.	15.26 mm. and over	Total	12.26-15.25 mm.	15.26 mm. and over	Total
January	0	0	0	40	6	46
February	0	0	0	216	74	290
March	0	0	0	2	43	45
April	0	0	0	3	5	8
May	0	0	0	0	0	0
June	12	40	52	0	4	4
July	0	4	4	0	0	0
August	-	-	-	27	6	33
September	-	-	-	91	27	118
October	0	0	0	5	7	12
November	0	0	0	-	-	-
December	0	0	0	-	-	-
Total	12	44	56	384	172	556

Text table 5.—Occurrence and abundance (standard haul totals) of sardine larvae, by month and area, in hauls made during 1957

Cruise	Central California 60–77		Southern California 80–93		Northern Baja California 97–107		Upper central Baja California 110–120		Lower central Baja California 123–137		Southern Baja California 140–157		Total	
	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber
5701	–	–	–	–	0	0	7	183	6	576	–	–	13	759
5702	–	–	0	0	3	114	10	317	5	164	5	349	23	944
5703	–	–	0	0	4	254	10	671	8	209	4	31	26	1,165
5704	–	–	3	370	3	44	2	8	0	0	0	0	8	422
5705	0	0	8	1,332	3	239	2	151	2	8	–	–	15	1,730
5706	4	87	8	60	7	55	4	34	0	0	3	48	26	284
5707	2	7	1	48	2	51	11	1,338	1	3	–	–	17	1,447
5708	–	–	–	–	–	–	14	1,257	5	256	–	–	19	1,513
5709	–	–	–	–	–	–	15	1,016	1	20	–	–	16	1,036
5710	–	–	0	0	0	0	8	278	3	37	–	–	11	315
5711	0	0	1	218	0	0	–	–	–	–	–	–	1	218
5712	–	–	0	0	–	–	–	–	–	–	–	–	0	0
Total	6	94	21	2,028	22	757	83	5,253	31	1,273	12	428	175	9,833
Percent		0.96		20.62		7.70		53.42		12.95		4.35		100.00

Table III

Record of sardine larvae, 1957

Station	Midpoint of size class (in mm.) 3.00	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	25.25	Dis.	Total
Cruise 5701:																				
117.26									2.6											2.6
.30					10.6			21.1	10.6											42.3
.40							21.4													21.4
120.30				19.6	29.6	14.7														63.9
.35		2.3	4.7	2.3	9.3	11.7	4.7	2.3												37.3
.40		2.4	1.2				2.4		1.2											7.2
.45	2.8	2.8						2.8												8.4
123.37																			2.5	2.5
127.34		39.0	146.4	22.0	2.4	17.1	24.4	12.2	4.8	7.3	4.8									280.4
.40			5.5		27.3	65.5	65.6	49.1	21.9	16.4	5.5	5.5	5.5							267.8
130.35		5.3																		5.3
.40		5.8					11.6													17.4
137.23			2.4																	2.4
Total	2.8	57.6	160.2	43.9	79.2	109.0	130.1	87.5	41.1	23.7	10.3	5.5	5.5						2.5	758.9
Cruise 5702:																				
103.30		27.2																		27.2
.35	27.7																			27.7
107.32*																				
.35*		11.9	47.7																	59.6
110.33		10.4																		10.4
.40			5.6											2.8						8.4
113.40		2.5	2.5	7.5																12.5
117.26								9.4			18.8		9.4							37.6
.30									33.4		33.4	100.3	33.4							200.5
120.25	12.0																			12.0
.30														11.7						11.7
.35				4.9																4.9
.40		4.7	2.4	7.1	2.4															16.6
.45											2.8									2.8

* - Samples combined. Values were adjusted accordingly.

Table III (cont'd)
Record of sardine larvae, 1957

Station	Midpoint of size class (in mm.) 3.00	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	25.25	Dis.	Total
Cruise 5702 (cont'd):																				
123.37	13.6																			13.6
.55												4.5		4.5						9.0
127.34	57.9																			57.9
130.30							6.4													6.4
137.23		4.3	25.5	25.6	12.8	4.3	4.3													76.8
140.35								7.3	3.7	3.7										14.7
.40								2.8					2.8			2.8				8.4
147.20				3.1			3.1	12.4	3.1	15.5	3.1		3.1		3.1					46.5
.25	3.6	21.8	32.7																	58.1
150.25		3.1	9.2	24.6	40.1	33.9	24.6	30.8	21.5	30.8	3.1									221.7
Total	114.8	85.9	125.6	72.8	55.3	38.2	38.4	62.7	61.7	50.0	61.2	104.8	48.7	19.0	3.1	2.8				945.0
Cruise 5703:																				
103.30	29.4	35.1	23.5	14.7	2.9															105.6
.35		26.1	2.9																	29.0
107.32		36.5	63.1	16.6																116.2
.35			3.2																	3.2
110.40			3.3																	3.3
113.35	12.7			12.7																25.4
.40		14.0																		14.0
117.30		18.5	224.8	6.2																249.5
.35		151.8	151.8	13.8																317.4
.40		9.0	6.0																	15.0
.50			6.2																	6.2
.70		3.2																		3.2
119.33					6.5		6.5													13.0
120.25	24.0																			24.0
123.42				6.0	6.0															12.0
127.40		7.5	15.0					7.5												30.0
.45		43.8	43.8										11.0							98.6
.50			6.3	18.9	6.3	6.3														37.8
.55					13.5															13.5

Table III (cont'd)
Record of sardine larvae, 1957

Station	Midpoint of size class (in mm.) 3.00	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	25.25	Dis.	Total
Cruise 5703 (cont'd):																				
130.30															10.7					10.7
133.35				3.2																3.2
137.23									2.9											2.9
140.35													2.8	11.0						13.8
143.50														3.1						3.1
150.30									2.5	2.5					2.5					7.5
.40									4.2					2.1						6.3
Total	66.1	345.5	549.9	92.1	35.2	6.3	6.5	7.5	9.6	2.5			13.8	16.2	13.2					1,164.4
Cruise 5704:																				
90.45	26.4	13.2	13.2	13.2																66.0
93.45		61.8	185.4		12.4															259.6
.50		14.9	29.8																	44.7
100.33			5.2																	5.2
103.30		11.5	14.3	7.2	2.9															35.9
107.35			3.2																	3.2
117.60																5.3				5.3
.70												2.7								2.7
Total	26.4	101.4	251.1	20.4	15.3							2.7				5.3				422.6
Cruise 5705:																				
83.51			3.4																	3.4
90.50		2.8	5.6																	8.4
.55	138.8	505.7	66.5		5.8	2.9														719.7
.60	13.7	41.0			10.3		10.2													75.2
93.55				5.8	29.0	5.8														40.6
.60		24.7	151.4	98.9	132.9	55.6														463.5
.65				5.1		5.1														10.2
.70					8.1	2.7														10.8
97.30	178.4			4.5	4.5	4.5	4.5													196.4
.32	9.6		3.2																	12.8
100.33	12.8	12.7	2.1			2.1														29.7
117.45	137.4																			137.4
.50	5.6	8.4																		14.0
127.34	5.8																			5.8
133.30	2.3																			2.3
Total	504.4	595.3	232.2	114.3	190.6	78.7	14.7													1,730.2

Table III (cont'd)
Record of sardine larvae, 1957

Station	Midpoint of size class (in mm.)																	Dis.	Total
	3.00	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	25.25	
Cruise 5706:																			
73.70				3.1		12.4	21.7	12.4	3.1										52.7
.80								6.2											6.2
77.55				6.0		3.0													9.0
.60		6.4			6.4				6.4										19.2
80.60					11.0					5.5									16.5
.80									6.4										6.4
83.85										2.9									2.9
87.90															3.0				3.0
90.65	3.1																		3.1
93.55		6.6										3.3		6.6					16.5
.60														7.4					7.4
.65														3.7					3.7
97.55														6.6					6.6
.60														3.0					3.0
100.33		26.9	6.0																32.9
.55																	3.3		3.3
.70		2.8																	2.8
103.35															2.9				2.9
.60															3.4				3.4
110.45	6.1	6.1																	12.2
117.45	5.1	11.5																	16.6
120.35			3.4																3.4
.40		1.8																	1.8
148.20		17.4			2.9				2.9										23.2
.25			10.9												3.6			3.6	18.1
.30			6.9																6.9
Total	14.3	79.5	27.2	9.1	20.3	15.4	21.7	18.6	18.8	8.4		3.3		27.3	12.9		3.3		3.6	283.7

Table III (cont'd)
Record of sardine larvae, 1957

Station	Midpoint of size class (in mm.) 3.00	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	25.25	Dis.	Total
Cruise 5707:																				
67.80		3.2																		3.2
70.70																		4.2		4.2
82.47	7.9	10.5	5.2		5.2	5.2	7.9	2.6	2.6											47.1
97.30		2.0																		2.0
103.30	39.1	8.2	1.6																	48.9
110.33				3.4																3.4
113.30			6.2	4.2	8.2	14.5	16.6	6.2												55.9
.35	4.0																			4.0
117.26		10.2		3.4		3.4		3.4												20.4
.35	3.8																			3.8
.40						3.4														3.4
119.33	10.3	3.4	3.4			3.4														20.5
120.25	665.3	35.7	3.0																	704.0
.30	361.7	38.8	6.4	3.2																410.1
.35			8.6	37.3	5.7															51.6
.40	3.8	18.9	7.6	18.9	7.6	1.9		1.9												60.6
130.45		3.0																		3.0
Total	1095.9	133.9	42.0	70.4	26.7	31.8	24.5	14.1	2.6									4.2		1,446.1
Cruise 5708:																				
113.30				2.7		2.7														5.4
.35							2.7													2.7
115.27			2.9	28.9	69.4	49.1	28.9	11.6	8.7											199.5
117.26			11.7	17.6	32.1	46.7	43.8	55.5	26.2	5.8	5.8	5.8		2.9						253.9
.30							5.8	2.9	8.8	2.9										20.4
.35							6.4						3.2							9.6
118.25	3.0	33.2	3.0	3.0																42.2
.35	78.0	137.3																		215.3
119.33	34.8	2.9																		37.7
120.25	8.9	41.5	62.2	32.5	20.7	38.5	14.8	6.0	3.0	3.0										231.1
.30		6.7	3.3	3.3		10.0														23.3
.35	55.4	19.2		2.1																76.7
.40	4.0	12.2	16.3	20.3	24.4	28.4	12.2	10.2	4.1	4.1										136.2
.45									2.9											2.9
123.37	4.8	12.2	12.2	4.8		2.4														36.4
.45		3.0																		3.0
127.34	5.8	8.7	8.6	31.7	60.5	34.6	20.2	8.7	5.8											184.6

Table III (cont'd)
Record of sardine larvae, 1957

Station	Midpoint of size class (in mm.) 3.00	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	25.25	Dis.	Total
Cruise 5708 (cont'd):																				
127.40			6.7	3.4		13.4	3.4													26.9
130.30							2.7	2.7												5.4
Total	194.7	276.9	126.9	150.3	207.1	225.8	140.9	97.6	59.5	15.8	5.8	5.8	3.2	2.9						1,513.2
Cruise 5709:																				
110.33																2.4				2.4
113.30					2.4		7.1	9.5	4.7											23.7
.35				3.1	3.1															6.2
115.30														3.1						3.1
117.26				5.3	2.6															7.9
.35				3.0	3.0															6.0
.40			3.3				6.6	19.8	6.6	3.3			6.6	3.3						49.5
118.25		2.5	10.1	5.0	2.5	7.6	5.1	2.5	5.0											40.3
.30	15.0	15.0	41.2	37.4	67.5	78.7	78.7	37.5	11.3	11.3										393.6
119.33	6.0	11.9	17.8	17.9	6.0	9.0	6.0	6.0			3.0									83.6
120.25	6.3	3.2	3.2			3.2	6.3													22.2
.30	3.1	12.4	6.2		3.1			3.1												27.9
.35	3.0	18.0	3.0	12.0	12.0	12.0	15.0	12.0	3.0	3.0										93.0
.40		5.9	26.6	8.9	8.9		17.6	47.2	50.1	38.3	23.6	8.8	5.9	3.0	3.0					247.8
.45								5.6	2.8											8.4
123.37	3.4	10.1	3.4		3.4															20.3
Total	36.8	79.0	114.8	92.6	114.5	110.5	142.4	143.2	83.5	55.9	26.6	8.8	12.5	9.4	3.0	2.4				1,035.9
Cruise 5710:																				
113.30						2.8														2.8
117.26	6.0	69.2	21.0	3.0	6.0	6.0	3.0	3.0		3.0										120.2
.35							2.4			2.4										4.8
119.33	5.2	10.4	10.4	2.6	7.8	7.8	7.8													52.0
120.25	1.8	1.8	11.1	11.0	7.3			1.8												34.8
.30		27.5	10.5	2.1	2.1															42.2
.35	4.6	9.1	2.3		2.3															18.3
.60									3.0											3.0
123.37	10.8	13.6	2.7	2.7																29.8
.60														3.1						3.1
127.40															3.8					3.8
Total	28.4	131.6	58.0	21.4	25.5	16.6	13.2	4.8	3.0	5.4				3.1	3.8					314.8
Cruise 5711:																				
83.55	167.9	13.8	18.4	6.9	6.9	4.6														218.5
Total	167.9	13.8	18.4	6.9	6.9	4.6														218.5

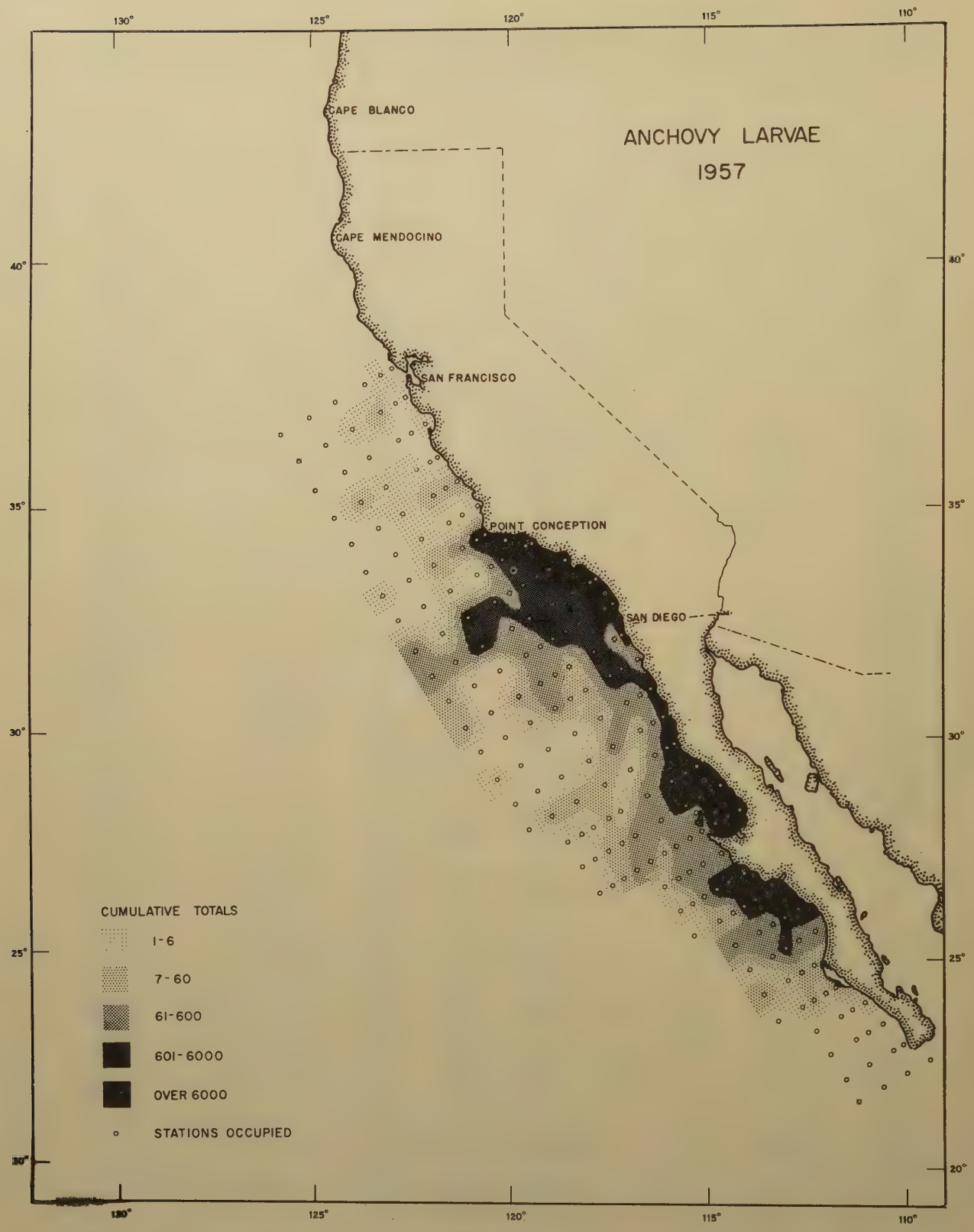


Figure 4.--Anchovy larvae, 1957: Distribution and relative abundance.

RECORD OF ANCHOVY LARVAE, 1957

The larvae of the northern anchovy, Engraulis mordax, are recorded by size in table IV. The size classes are similar to those used for sardine larvae except for the two smallest size categories which have the following midpoints and ranges:

Midpoint (mm.)	Size range (mm.)
2.50	1.76–3.25
3.75	3.26–4.25

The distribution and relative abundance of anchovy larvae are illustrated in figure 4. The value for each station is the cumulative standard haul total for the year.

Anchovy larvae ranked first in abundance in 1957, as in all recent years. The average number of anchovy larvae taken per haul has been exceptionally constant during the past three years:

Year	Total hauls taken	Occurrences	Total anchovy larvae (standard haul totals)	Average per haul
1955	1,375	616	140,183	102
1956	1,397	536	134,931	97
1957	1,493	580	146,631	98

In the previous report in this series, the unusual distribution of anchovy larvae during 1956 was noted. During that year, considerably fewer anchovy larvae were taken in the northern half of the survey area (lines 60–107) than in the southern portion. The most unusual feature of the distribution was the presence of large numbers of larvae off southern Baja California (lines 140–157), an area in which anchovy larvae are usually uncommon.

	1955		1956		1957	
Station lines	Number	Percent of total	Number	Percent of total	Number	Percent of total
60–77	38	0.03	629	0.5	206	0.1
80–93	30,147	21.5	17,838	13.3	79,923	54.5
97–107	30,092	21.5	8,463	6.3	10,791	7.4
110–120	68,568	48.9	61,565	45.8	32,583	22.2
123–137	11,269	8.0	20,884	15.1	23,014	15.7
140–157	69	0.05	25,552	19.0	114	0.1
Total	140,183	99.98	134,931	100.0	146,631	100.0

Only a few anchovy larvae were taken off southern Baja California in 1957 - less than 0.1 percent of the number taken in the CCOFI survey area, as compared to 19.0 percent in this area in 1956. A much higher percentage of the larvae were taken in the northern half of the survey area (station lines 60-107), however: 62.0 percent as compared to 20.1 percent in 1956. Water temperatures in the upper mixed layer, the stratum in which anchovy larvae occur, were higher in 1957 than in 1956, especially in the area off central and southern Baja California. The northward shift in larval distribution is probably related, directly or indirectly, to the increase in water temperatures in the CCOFI area.

The abundance of anchovy larvae in different parts of the CCOFI survey area in 1957 is summarized by month in text table 6. Almost a third of the larvae were obtained during the peak month, February. This was the month of peak abundance in all major subareas, an unusual circumstance as can be seen by comparing the 1957 areal abundance with that given for 1956 (Ahlstrom 1958, text table 5) or 1955 (Ahlstrom and Kramer 1957, text table 4). Anchovy spawning ordinarily takes place throughout the year in the area between Point Conception and Point San Juanico (station lines 80-137). There was a marked decrease in the number of larvae in the southern part of the range (lines 123-137) during the latter part of the year. There were only three occurrences in 64 hauls taken in this area during August through October, and these contained only small numbers of larvae. The increase in temperatures in this area (3° C higher than the average of the preceding six years during these months) may account for the decrease in anchovy larvae.

The monthly abundance of anchovy larvae during 1957 is compared with that of the preceding four years in text table 7. Throughout the five-year period, more anchovy larvae were taken during the winter months (January-March) than in the other seasons. Coverage during the last five months of the year has varied in intensity during this period, but in no year was it as thorough as during the earlier months, hence abundance during these months is underestimated. Even allowing for this fact, there is a marked decrease in numbers of larvae during the summer and fall months as compared to the other two seasons.

The abundance of anchovy larvae of different sizes is summarized for the five-year period, 1953-1957, in text table 8. A comparison of the larger larvae (12.26 mm. and over) is as follows:

Year	Standard haul total	Larvae over 12.26 mm.	Percent of total
1953	99,160	2,294	2.31
1954	161,326	4,366	2.71
1955	140,188	3,773	2.69
1956	134,931	4,599	3.41
1957	146,631	4,253	2.90

Text table 6.—Occurrence and abundance (standard haul totals) of anchovy larvae (Engraulis mordax), by month and area, in hauls made during 1957

Cruise	Central California 60-77		Southern California 80-93		Northern Baja California 97-107		Upper central Baja California 110-120		Lower central Baja California 123-137		Southern Baja California 140-157		Total	
	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber
5701	–	–	–	–	4	604	17	6,581	11	3,314	–	–	32	10,499
5702	–	–	23	23,280	17	3,486	17	9,279	22	12,202	3	13	82	48,260
5703	–	–	23	6,723	9	1,052	19	4,725	17	1,750	5	79	73	14,329
5704	–	–	25	16,879	21	2,237	13	734	12	364	3	18	74	20,232
5705	3	14	21	15,203	12	2,090	30	2,906	11	582	–	–	77	20,795
5706	7	122	33	11,098	8	103	31	5,107	10	1,973	1	4	90	18,407
5707	5	23	24	3,834	9	493	17	1,735	12	2,801	–	–	67	8,886
5708	–	–	–	–	–	–	17	1,440	2	6	–	–	19	1,446
5709	–	–	–	–	–	–	7	35	0	0	–	–	7	35
5710	–	–	13	311	8	487	4	41	1	22	–	–	26	861
5711	2	47	19	2,153	5	173	–	–	–	–	–	–	26	2,373
5712	–	–	6	442	1	66	0	0	–	–	–	–	7	508
Total	17	206	187	79,923	94	10,791	172	32,583	98	23,014	12	114	580	146,631
Percent		0.14		54.51		7.36		22.22		15.70		0.07		100.00

Text table 7.--Monthly abundance of anchovy larvae 1953-1957, based on standard haul summations

Month	1953	1954	1955	1956	1957
January	12,820	24,853	40,143	8,847	10,499
February	16,199	32,709	30,951	29,136	48,261
March	15,841	34,314	25,081	16,642	14,328
April	6,920	32,833	16,490	22,857	20,232
May	3,496	12,494	4,201	11,937	20,796
June	4,886	6,497	12,656	18,261	18,407
July	5,639	8,661	7,058	14,717	8,886
August	2,856	1,875	-	9,635	1,446
September	3,009	-	720	373	35
October	6,096	1,248	647	825	862
November	7,470	-	1,155	1,424	2,371
December	13,928	5,842	1,086	277	508
Total	99,160	161,326	140,188	134,931	146,631

Text table 8.--Abundance of anchovy larvae by size categories, 1953-1957, based on standard haul summations

Size (mm.)	1953	1954	1955	1956	1957
2.50	15,112	33,466	19,707	13,993	19,983
3.75	19,453	24,407	29,109	21,246	23,640
4.75	17,462	19,898	17,187	15,463	19,915
5.75	12,153	19,428	18,540	14,635	18,276
6.75	10,474	19,992	15,738	16,710	17,126
7.75	7,780	14,596	12,646	15,105	14,592
8.75	5,764	10,747	9,691	12,351	11,930
9.75	4,283	6,902	6,850	9,946	8,422
10.75	2,627	4,406	4,386	6,839	5,179
11.75	1,619	2,848	2,392	4,027	3,237
12.75	804	1,812	1,458	2,159	1,817
13.75	562	999	838	1,046	942
14.75	325	639	523	535	587
15.75	187	371	302	274	302
17.25	236	304	412	310	381
19.25	70	178	144	217	119
21.25	42	37	43	15	66
23.25	68	26	53	43	39
Disintegrated	139	270	169	17	78
Total	99,160	161,326	140,188	134,931	146,631

Table IV
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5701:																				
103.30	7.3	14.8	22.1	17.2	7.3	2.4	2.4													73.5
.35	2.9	11.6	14.5	2.9																31.9
107.32	168.2	98.6	23.2	29.0	29.0	11.6	17.4	5.8												382.8
.35	66.7	23.2	8.7	5.8		5.8	5.8													116.0
110.40					2.9															2.9
113.30	57.3	15.0	29.9	34.8	77.2	44.8	22.4	20.0	2.5	2.5										306.4
.35	2.7	5.4	5.4	8.1	13.6	2.7														37.9
.40									2.6											2.6
117.26	111.0	719.8	221.9	252.9	134.1	85.2	43.8	15.5	5.2	5.2										1,594.6
.30	31.7	211.2	380.1	1108.8	591.4	147.8	73.9	95.0	63.3	31.7										2,734.9
.35	21.4	42.7	32.1	53.4	53.4	10.7	21.4	10.7	10.7											256.5
.40		235.0	309.7	149.5	53.4	53.4	85.4	21.4	21.4	21.4	10.7	10.7	10.7	10.7	10.7					1,004.1
.50			15.8	21.1		13.2	18.5	29.1	18.5	7.9	10.5	5.2		2.6						142.4
.60			5.4	8.1	2.7	5.4	2.7	2.7											2.7	29.7
120.25							18.2	18.2	27.3											63.7
.30		9.8	14.8	39.4	9.8	19.6	68.9	54.1	64.0	44.3	9.8	4.9								339.4
.35		4.6								2.3										6.9
.40	2.4	6.3	3.8																	12.5
.45		5.6	5.6			5.6			2.8	2.8										22.4
.55						2.8	2.8													5.6
.60					2.6	2.6	2.6		10.5											18.3
123.37	86.2	12.3		4.9	2.5	7.4	2.5	2.5	2.5	5.0										125.8
.42	2.8			2.8	5.5	5.6	5.5													22.2
.50								2.8												2.8
127.34	21.9	22.0	46.3	100.1	207.4	156.2	90.3	65.9	56.1	22.0	14.6		7.3							810.1
.40		11.0	43.7	120.2	109.2	54.6	65.6	71.0	43.7	32.7	27.3	5.5	16.4							600.9
130.30	71.7	4.8	9.6	4.8	4.8	4.8														100.5
.35		5.3	5.3	15.8	5.3	21.1	5.3													58.1
.40			28.9	52.1	46.2	92.5	80.9	23.1	17.4	11.6	5.8	5.8				5.8				370.1
.50					5.7															5.7
133.25		21.1	128.9	381.3	349.8	239.3	76.3	13.1			2.6									1,212.4
137.30					2.8	2.8														5.6
Total	654.2	1480.1	1355.7	2413.0	1716.6	997.9	712.6	450.9	348.5	189.4	81.3	32.1	34.4	13.3	10.7	5.8			2.7	10,499.2

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5702:																				
80.51			2.5	7.4	12.4	49.4	64.2	32.1	7.4	7.4	5.0									187.8
.55						190.0	47.5	47.5	95.0											380.0
.60		3.4	6.8	13.6	16.9	10.2	3.4	3.4		6.8										64.5
83.40	31.9	29.0	46.4	37.7	34.8	40.6	75.4	52.2	26.1	20.3	5.8		5.8							406.0
.43	12.0		24.0	24.0	23.9	12.0		12.0	12.0											119.9
.51	54.2	90.4	90.4	126.5	18.1	54.3	18.1	18.1												470.1
.52	41.1	41.1	30.8	10.3	41.1															164.4
86.46	32.8	65.5	49.1		32.8	49.1	16.4													245.7
87.36	90.8	288.3	165.6	128.2	165.5	154.8	133.5	144.2	48.0	37.4	21.4									1,377.7
.38	1236.3	2593.6	739.3	351.5	303.0	278.8	242.4	181.8	97.0	36.3	12.1	12.1								6,084.2
.40	1689.1	2080.8	2252.1	1003.7	832.3	465.1	367.2	98.0	73.5		24.5									8,886.3
.50		6.0			3.0	3.0	3.0													15.0
.55	20.3	20.3				20.3														60.9
90.28	11.0	60.3	54.8	60.3	32.8	27.4	27.4	5.5												279.5
.30		25.0	25.0			25.0														75.0
.37			41.9																	41.9
.55	71.0	71.1	47.4		59.2	23.7	11.8	59.2	23.6	23.7		11.8								402.5
.60	2.9				5.8		14.5	23.3	14.5	5.8										66.8
93.27	516.7	424.8	309.9	126.3	91.8	114.8	11.5	23.0												1,618.8
.30	26.7	53.4	21.3	21.3	21.4	5.3		5.3												154.7
.40	110.8	487.5	265.9	44.3																908.5
.50	630.3	259.6	74.1	86.5	37.1		24.7	24.7	12.4											1,149.4
.60	40.3	67.2	13.4																	120.9
97.30	10.6	10.7	8.0	18.7	32.0	16.0	8.0	2.7												106.7
.40	6.2	6.2	30.9	30.9	24.8	24.7	6.2	6.2	6.2											142.3
.60			51.8	77.7	25.9	25.9	25.9		51.8		51.8		25.9							336.7
.70							2.9				2.9									5.8
100.29			17.9	44.7	17.9	12.0	3.0													95.5
.33		112.0	89.6	22.4	44.8	11.2	11.2													291.2
.40	380.8	224.0	179.2	89.6	67.2	44.8		22.4												1,008.0
.50										44.5										44.5
.60							6.8	3.4	13.6		3.4									27.2
103.30			27.2	81.6	27.2	108.8	54.4	27.2	27.2											353.6
.35	27.7	166.1		83.0	55.4	27.7		27.7	55.4											443.0
.38	52.5	111.5	78.7		6.6	6.6	19.7													276.6
.40			6.3		12.6				6.3											25.2
.50	14.4	14.4					7.2				7.2			14.4						57.6

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5702 (cont'd):																				
107.32*		23.8	23.8	47.6	11.9	59.6	11.9		11.9	11.9										202.4
.35*																				
.50		38.0	27.2																	65.2
.60											5.6									5.6
110.33		94.0	177.5	292.3	177.4	135.7	219.3	93.9	62.7	41.7	41.8	10.4			10.4					1,357.1
.35	12.4	12.4	49.5	49.5	24.7	24.8	61.8	37.1	24.7	37.1	24.7			12.4						371.1
.40	2.8	69.7	16.8	14.0	36.2	67.0	44.7	36.2	30.7	2.8	14.0									334.9
.50			2.7	2.7																5.4
113.30	5.1	10.2	20.5	35.9	51.2	56.3	51.2	15.3	15.3	5.1		5.1								271.2
.35		20.0	65.0	110.0	80.0	15.0	30.0	5.0												325.0
.40	10.1	55.4	58.0	50.4	37.8	32.8	5.0	2.5												252.0
117.26		56.6	18.9	28.3	132.1	141.6	188.8	198.2	169.9	84.9	37.8	47.2	37.7	9.4	18.9					1,170.3
.30			133.7	100.3	234.1	200.6	568.5	568.4	367.9	267.6	167.2		33.4	33.4	33.4					2,708.5
.35			24.6	24.6	98.5															147.7
.40		9.2		2.3	6.9	2.3				4.6		2.3								27.6
.50	2.8	28.1	2.8	8.4			2.8													44.9
120.25	23.8	12.0	89.4	53.7	71.5	89.4	77.5	53.6	29.8	29.8		6.0			6.0					542.5
.30			23.4	152.3	246.1	187.5	328.2	281.3	187.6	46.8	35.2	11.7	11.7							1,511.8
.35				19.5	4.9	4.9		4.9				4.9								39.1
.40			7.1	7.1	7.1		7.1	7.1		2.4	4.8									42.7
.45		13.9	44.3	8.3	5.5	8.3	2.8	27.7	11.1	2.8	2.8									127.5
123.37	22.1	25.5	13.6	10.2	3.4		1.7	6.8	5.1	5.1	11.9	10.2	1.7	1.7						119.0
.42			13.4	13.3	10.6	8.0	8.0	2.7	2.7											58.7
.50			19.1	4.8	4.8		4.8													33.5
.55				9.0	4.5	9.1	54.5	49.9	9.0	4.5	4.5	9.0								154.0
.60																			4.4	4.4
127.34	34.1	29.0	7.9	5.2		2.6	2.6	7.9	5.3											94.6
.40	7.0		14.0				7.0													28.0
.45		10.0	10.0	50.2	80.3	100.4	120.4	130.6	70.3	30.1										602.3
.55						3.5														3.5
.60							2.7	2.7												5.4
130.30	25.6	281.6	748.8	614.4	153.6	44.8	25.6	12.8	6.4	19.2	6.4	6.4								1,945.6
.35		21.8	34.9	30.5	21.8	52.3	65.4	52.4	43.6	39.3	34.8	34.9	13.1	8.8						453.6
.40		5.2	13.0	13.0	15.6	15.6	5.2	7.8		2.6	2.6									80.6
.50		6.0																		6.0

* - Samples combined. Values adjusted accordingly.

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5702 (cont'd):																				
133.25	242.9	2130.7	2252.2	1236.5	452.7	353.3	88.4	11.0		44.1	11.0	22.1	33.1							6,878.0
.30	19.0	151.7	720.5	274.9	113.7	85.3	19.0	19.0	9.5	38.0	9.5	9.5								1,469.6
.50							3.2													3.2
137.23				4.3		8.6	8.5			4.3										25.7
.30								10.0												10.0
.35				9.8	24.6	19.6	49.2	34.5	29.6	4.9	9.8	9.8	9.8	4.9						206.5
.40				2.2		13.2	2.2													17.6
.50						2.4														2.4
140.35		3.7																		3.7
.40										2.8					2.8					5.6
.50										3.4										3.4
Total	5518.1		9382.9		4157.8		3274.3		1663.1	918.0	558.5	213.4	172.2	85.0	71.5				4.4	48,260.8
		10420.7		5775.7		3546.0		2499.2												
Cruise 5703:																				
80.51							3.0													3.0
82.47			2.8																	2.8
83.40							2.0					2.0								4.0
.43								2.8												2.8
.48						2.5			5.0		2.5									10.0
.51						2.7	5.4	2.7	2.7	2.7										16.2
87.36		6.0	12.0	24.1	84.3	48.2	54.2	30.1	30.1	12.0										301.0
.40	11.0	22.1	66.2	55.2	55.2	143.6	154.6	187.7	132.5	33.1	22.1	44.2								927.5
.45	6.2	25.0			6.2	24.9		6.2												68.5
.50								23.4		11.7										35.1
.70					82.4	94.1	199.9	117.6	82.3			11.8								588.1
90.28	65.2	229.6	204.7	101.2	31.5	15.8	24.8	15.8	18.0	11.3	2.2									720.1
.30	73.3	60.0		13.3		13.4	46.6	13.3			13.3									233.2
.37	96.3	108.4	84.3	108.4	216.7	156.5	84.3	24.0												878.9
.45	11.7	17.5	23.4	29.2	37.9	20.5	32.1													172.3
.60	34.2	17.1	5.7				11.4	17.1	5.7		5.7									96.9
.70				33.6	156.8	246.4	257.6	134.4												828.8
.80			22.8	5.7	74.4	97.3	108.7	28.6	5.7											343.2
93.27	115.5	35.5	11.9	14.8	32.6	68.0	79.9	38.4	5.9	3.0										405.5
.30	133.7	86.1	14.9	5.9	3.0	3.0	3.0	3.0												252.6

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5703 (cont'd):																				
93.40	32.3	25.8	3.2	3.2	6.5	22.7	12.9	19.4			3.2									129.2
.50	12.0	18.0	72.3	72.2	72.2	24.0	48.1	90.3	42.2	6.0	6.0									463.3
.60				16.2	16.2	38.9	58.4	74.5	22.7	3.2	3.2	3.2	3.2							239.7
97.30	65.8	222.6	25.3	10.1	30.3		10.2		5.1											369.4
.40	99.2	142.6	52.7	18.6	3.1															316.2
.50		22.8						5.7			5.7									34.2
100.29				7.0	3.5	10.5		3.5		3.5										28.0
.33						6.8	27.4	17.1	24.0	30.8	6.8	6.8	3.4							123.1
.40			3.1				6.1		6.2	6.1	3.1	6.1								30.7
103.30	2.9	26.3	2.9	2.9	5.9	8.8		2.9	5.8											58.4
.35	2.9	5.8																		8.7
107.32		26.6	6.6	33.2	13.3		3.3													83.0
110.33						4.5									4.5					9.0
.35				14.0	35.1	10.5	10.5	7.0		3.5	3.5	3.5	3.5		14.0					105.1
.40											3.3									3.3
113.30	5.8	5.8	11.6	5.8	5.8			11.6	11.6	23.2								5.8		87.0
.35		12.7	50.7	12.7	12.7	50.8		12.7		12.7		12.7			12.7					190.4
.40				7.0	14.0	7.0														28.0
.50				3.3																3.3
.60					3.2															3.2
117.30			6.2	9.3	43.2	33.8	30.8	21.5	9.3	6.2										160.3
.35	82.8	110.4	262.2	386.4	372.6	124.2		13.8	13.8											1,366.2
.40	3.0	6.0	17.9	20.9	9.0	3.0	3.0											3.0	3.0	68.8
.50				18.7	18.7	18.7	12.4	12.4	6.2											87.1
.60				6.1			3.1												3.1	12.3
.70	3.2			3.2																6.4
118.39	95.6	57.3	28.7	38.3	9.6		9.6													239.1
119.33	45.3	13.0	110.2	123.1	64.8	13.0			6.5											375.9
120.25	429.1	882.1	429.1	65.5				6.0												1,811.8
.30	48.2	12.0	36.1	36.1			12.0	12.0												156.4
.60	11.4																			11.4
123.37									3.2			3.2								6.4
127.34	76.3	18.3		3.0				3.0		9.1	3.0									112.7
.40		7.5		22.5	22.5	15.0	15.0		15.0	7.5			7.5							112.5
.45		54.8	21.9	54.8	54.8							22.0			11.0	21.9				241.2
.50			6.3		31.5	37.8	6.3													81.9

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5703 (cont'd):																				
130.30								10.7			21.4	10.7								42.8
.40									2.7											2.7
.50					3.4		3.4													6.8
133.25				20.5	30.7	20.4	30.7													102.3
.30		10.9	21.8	21.8	54.6	10.9	10.9	10.9	10.9											152.7
.35	29.0	35.4	9.7																	74.1
.40					2.9	2.9														5.8
137.23					8.6	2.9														11.5
.30				2.8	2.8															5.6
.35	11.7	99.3	332.9	99.3	5.8					5.8										554.8
.40		17.4	46.6	58.2	66.9	34.9	2.9	2.9	2.9											232.7
.50				3.2																3.2
140.30								2.7	5.4	5.4		2.7		2.7						18.9
.35							5.5	8.3	13.7	5.6	5.5	2.8								41.4
143.26									2.9			2.9								5.8
.30																			3.3	3.3
.35											9.8									9.8
Total	1603.6	2440.7	2006.7	1591.3	1805.2	1438.9	1390.0	994.0	498.0	202.4	120.3	134.6	17.6	2.7	42.2	21.9		8.8	9.4	14,328.3
Cruise 5704:																				
82.47		5.4	2.7	8.1	8.1	10.8	16.2	10.8		8.1	2.7									72.9
83.40	78.8	7.9	23.6	94.5																204.8
.43				13.2	13.2	6.6														33.0
.51				19.3	9.6	9.6	24.1		14.4	19.3										96.3
86.46		39.4	88.6	118.0	98.4	78.7	34.5	24.6	4.9											487.1
87.36	20.7	132.5	385.0	285.6	248.4	120.1	24.9	20.7	8.2											1,246.1
.40		9.7	48.6	68.1	136.1	68.1	106.9	48.6	38.8	9.7	19.4									554.0
.50		55.0	220.1	440.3	522.9	440.3	385.2	275.2	82.5		27.5									2,449.0
90.28	554.6	1303.5	474.0	331.8	132.7	85.3	71.1	14.2	4.7											2,971.9
.30	70.5	274.4	62.7	23.5	23.5	7.8	23.5	47.0	23.5	23.5										579.9
.37	260.4	111.6	74.4	161.2	111.6	74.4	74.4	12.4	24.8											905.2
.45				13.2	79.0	144.8	144.8	210.5	79.0	92.1	13.2									776.6
.55	13.6							13.6		13.6										40.8
.60								2.9												2.9
.80								12.4												12.4
.90						13.2	79.5	53.0	66.2	13.2					6.6					231.7

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5704 (cont'd):																				
93.27	62.8	270.0	389.3	219.8	138.1	43.9	18.9	25.1	12.6											1,180.5
.30	477.5	300.1	272.8	122.8	81.8	95.5	27.2	13.6	27.2											1,418.5
.35	73.5	110.1	55.1	73.4	113.7	84.4	44.1	44.1	33.1	11.0										642.5
.40	100.0	40.0	20.0	80.0	200.0	280.0	180.0	140.0	100.0	40.0		20.0								1,200.0
.45		12.4	49.4	160.7	111.2	185.4	284.3	173.0	160.7	61.8	24.8				12.4					1,236.1
.50	14.9		14.9		14.9	44.7	44.7	44.8	14.9	59.6	14.9									268.3
.55			9.6	33.6	14.4	28.8	19.2	33.6	38.4	4.8	4.8			4.8						192.0
.60					34.2	11.4				11.4										57.0
.90								6.4	12.7											19.1
97.30	55.0	101.0	73.4	27.5	42.8	33.7	15.3	18.3												367.0
.32	203.8	17.0		5.7	17.0	50.9	17.0	22.6	5.7	5.7										345.4
.40									6.0	6.0										12.0
.45							6.1		12.2											18.3
.60											12.8		12.8		12.8					38.4
.70								2.8												2.8
.90								15.3				7.7								23.0
100.29	5.2	5.2		10.5	10.5	15.7	20.9	94.3	78.6	57.6	15.7		5.2	5.2						324.6
.33		26.1			5.2	5.2	31.4	62.6	26.1	31.3	5.2									193.1
.40	4.9	19.6	4.9						4.9	14.7	14.7									63.7
.45			6.3	9.5	3.2	6.4		3.2			3.2	3.2								35.0
.50																			3.1	3.1
.60						4.8					4.8	19.2	4.8							33.6
.70											1.8									1.8
103.30	2.9	1.4	28.6	61.5	40.0	7.1	10.0	17.2	24.4	62.9	60.1	37.2	12.9	8.6	4.3					379.1
.40											2.8		2.8		2.8					8.4
.90								3.1												3.1
107.32			6.4	6.4			12.8	6.4	31.9	44.7	12.8									121.4
.35	3.2		22.8	48.8	58.4	22.7	13.0	22.8	16.2	16.3	9.7									233.9
.40				10.0		3.3			3.3	3.3	3.3					3.3				26.5
.45						2.8														2.8
110.33										21.4		21.4								42.8
.35					6.3	18.9	18.9	6.3	6.3	6.3		31.4	12.6		12.6	6.3				125.9
.40							14.1	7.1	7.1		35.3	28.2	21.2	7.1	35.4	7.1	14.2			176.8
.45						3.0														3.0

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5704 (cont'd):																				
113.30				1.7			1.7	1.7	5.1	24.0	39.5	46.5	43.0	32.7	24.2	11.9				232.0
.35									4.0	8.0										12.0
117.26		8.5	2.8	8.5	8.5	2.8	5.7													36.8
.30	3.8	3.8		3.8							3.8				3.8					19.0
.60													5.3	5.3	5.3			5.3		21.2
120.25					4.8	7.3			2.4									2.4		16.9
.30			2.1																	2.1
.35			7.6		15.2															22.8
.50																	23.1			23.1
123.42	5.8	5.8					5.8													17.4
.70								2.1												2.1
127.34				1.6	1.6			1.6			1.6		1.6			1.6		1.6		11.2
.45	6.1	3.0		3.0		6.1		6.1												24.3
.50					10.6															10.6
130.35	4.2	25.2																		29.4
133.30		19.4																		19.4
.35	3.0	8.9		3.0																14.9
.40		107.0																		107.0
137.23	39.6	6.6																		46.2
.40		38.1	19.0																	57.1
.45	9.6	14.4																		24.0
140.50	5.0	5.0																		10.0
143.26							2.6				2.6									5.2
147.20											3.0									3.0
Total	2079.4	3088.0	2364.7	2468.6	2315.9	2024.5	1778.8	1520.0	980.8	670.3	340.0	214.8	122.2	63.7	120.2	30.2	37.3	9.3	3.1	20,231.8
Cruise 5705:																				
60.55		4.8																		4.8
63.52	4.4																			4.4
73.60					4.6															4.6
82.47								37.3	27.9	46.6	28.0	9.3		9.3						158.4
83.40	2566.3	372.3	225.6	530.2	569.7	220.0	73.4	22.6	11.3	5.6	5.6	5.6	5.6							4,613.8
.43				50.4	60.5	80.6	20.2	30.3	10.1	10.1	10.1				10.1					282.4
.51			3.4					6.9		3.4										13.7

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5705 (cont'd):																				
87.36	455.9	799.2	787.4	538.7	219.0	88.8	29.6	17.7												2,936.3
.40	26.3	157.7	280.3	289.1	481.8	402.9	297.9	87.6	61.4	17.6		8.8								2,111.4
.45	13.9	111.3	236.7	501.2	473.3	167.0	97.5	41.7	13.9											1,656.5
.50			5.5	14.6	7.4	11.0	1.8	1.8								1.8				43.9
90.28	107.2	61.6	50.9	42.9	34.8	18.7	10.8	8.1	2.7											337.7
.30	226.9	85.1	43.5	45.4	35.9	32.1	11.3	1.9											5.7	487.8
.37	50.7	101.4	44.4	38.0	34.8	19.0	6.4		3.2											297.9
.45	81.3	16.3		5.4																103.0
.50			2.8	11.1	19.4	30.5			2.8											66.6
.65	28.2																			28.2
.75														3.3				3.3		6.6
.85															2.5					2.5
93.27	189.0	45.0			27.0	27.0		36.0	9.0											333.0
.30	158.3	227.3	184.8	194.9	115.7	69.0	58.9	52.8	24.4	6.1	4.0	4.0	2.0		2.0					1,104.2
.35	143.6	37.4	39.5	104.0	62.4	35.3	16.6	2.1	4.2											445.1
.45	10.5	47.3	42.1	28.9	18.4	7.9	2.6							2.6						160.3
.50			4.6		9.2															13.8
97.30		13.4	49.1	75.8	49.1	44.6	49.1	26.8	4.5											312.4
.32					6.4	12.8														19.2
.45														2.6				2.6*		5.2
.50									2.9											2.9
100.29			9.0		4.5	9.0	18.1	13.5	18.0											72.1
.33			34.0	110.7	153.4	136.4	119.3	102.2	8.5	42.6	8.5	17.0	17.0	8.5	17.0	8.5	8.5			792.1
.40										3.7										3.7
.50																	2.4			2.4
.55								9.1												9.1
103.30				4.5	9.0	45.2	72.3	63.2	63.3	76.8	36.2	13.5	22.6	9.0	4.5		4.5			424.6
.35									3.3											3.3
107.32						36.9	55.4	110.9	92.4	64.7	36.9	9.2	9.2	9.2		18.5				443.3
110.40									23.4											23.4
.45												3.1		6.2						9.3
.60			6.0		3.0															9.0
.65	5.3	5.3																		10.6
.70	13.2	5.3	2.6																	21.1
.75		28.9	5.8	2.9	2.9															40.5

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5795 (cont'd):																				
113.35	105.4	80.6																		186.0
.40	835.7	73.2																		908.9
.45	2.7																			2.7
.50	15.8	21.2	2.6																	39.6
.65	10.8		2.7		2.7															16.2
.75	2.6																			2.6
117.26				6.6	6.7	6.7	3.3	6.7												30.0
.30	23.3	9.4				9.4	4.7		4.7											51.5
.35							4.1													4.1
.40	8.1																			8.1
.50				8.4	5.6	2.8	2.8		2.8											22.4
.55	449.9	73.0																		522.9
.60					6.2															6.2
118.39	3.0					12.0	12.1	3.0	6.0											36.1
119.33			5.4	32.1	80.4	107.2	26.8	5.4												257.3
120.25		7.4	3.7			7.4	3.7	3.7												25.9
.30			33.5	22.4	55.8	11.2	22.3	11.2												156.4
.40	7.6	3.0																		10.6
.45		5.1		7.6	2.5	2.5	2.5													20.2
.50	2.6	2.6	2.6	20.8	15.6	7.8														52.0
.55			2.8		2.8	2.8														8.4
.60				23.3	11.6	46.6	23.3	34.9												139.7
.65	36.4	66.7	24.2	36.3	54.5	30.3	12.2	6.1		6.1		6.1								278.9
.70						5.9														5.9
123.37					7.9	7.8	19.6	9.8	2.0		2.0									49.1
.42					8.1	10.8	5.4	2.7												27.0
127.34	8.7	2.9				2.9														14.5
130.30	47.1																			47.1
.40								4.4												4.4
133.25	9.3	37.3	18.6	28.0	18.6															111.8
.30	37.1	39.4	14.0	4.6																95.1
.40						2.6														2.6
.50	3.1							3.1	3.1											9.3
137.23		11.2	44.9	45.0		11.2	11.2													123.5
.30	2.8	25.1	22.3	19.6	25.2		2.8													97.8
Total	5693.0	2577.7	2235.3	2843.4	2706.4	1782.6	1098.0	763.5	405.8	283.3	131.3	76.6	56.4	50.7	36.1	28.8	15.4	3.3 2.6*	5.7	20,795.9

* - 2.6 at 24.5 mm.

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5706:																				
63.60								13.0												13.0
67.50										3.3										3.3
70.60						6.3														6.3
.80							12.8		12.8											25.6
73.55								15.4		15.4	15.4									46.2
.60				12.1							12.1									24.2
.70										3.1										3.1
80.51										12.7			12.7							25.4
.90	6.0																			6.0
83.40	199.8	111.6	104.4	68.4	32.4	3.6														520.2
.43	2.6	15.7	36.7	52.4	68.1	34.1	18.4	13.1	13.1	2.6										256.8
.51	35.5	92.4	60.4	71.0	95.9	60.3	32.0	31.9	21.3	7.1										507.8
.55		3.4	10.1	23.6	37.1	23.6	16.8	6.8	10.1	3.4										134.9
87.35	500.3	473.2	121.7	121.7	54.0	81.1	40.5													1,392.5
.40	32.3	153.6	56.6	16.2																258.7
.45	8.2	28.5	24.4			12.2	20.4	16.4	16.3	4.1	4.1									134.6
.50			17.3	23.1	17.4	52.0	34.6	69.3	63.6	46.2	17.4	5.8								346.7
.55			11.4	5.7	22.8	11.4	11.4	22.7	39.8	68.2	68.1	39.8	22.7	11.4	28.5	5.7				369.6
.60			15.2	45.8	198.6	313.3	198.6	114.6	45.8	15.3		7.6								954.8
.65						5.5														5.5
.70						13.0	13.0	13.0		13.0										52.0
.75					6.0	5.9	8.9								3.0					23.8
.80			3.1			3.1														6.2
90.28	762.3	571.7	254.1	55.6	87.3	31.7	31.7	31.7	7.9											1,834.0
.30	701.3	228.5	47.3	55.1	47.3	15.8	15.8													1,111.1
.37	446.6	459.4	191.4	306.2	382.8	165.8	38.3	38.3	25.6											2,054.4
.45	78.8	64.5	71.6	57.2	50.1	35.8	57.3	35.8	28.7	21.5	14.4		7.2				7.2			530.1
.50		3.6	3.6						7.2											14.4
.55							7.0		21.0											28.0
.60					6.3	6.3	6.3	18.9	31.5	37.8	69.3	37.8		6.3	6.3					226.8
.65									3.1		3.1			3.1						9.3
.70															3.1			3.1*		6.2
.75															15.0					15.0
.90														3.4		6.8				10.2

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5706 (cont'd):																				
93.27				14.8	14.8	29.6	22.2	22.2	14.8	11.1										129.5
.30				2.9																2.9
.35								3.1												3.1
.40	3.1	18.6																		21.7
.50			3.4																	3.4
.55		6.6	13.2	55.8	26.3															101.9
97.55				19.7	19.8	19.8	6.6													65.9
.60																			3.0	3.0
100.29											11.9									11.9
.45					3.0															3.0
.55				3.3		3.3														6.6
.60				6.2																6.2
107.55															3.1					3.1
.65														3.3						3.3
110.33							3.2													3.2
.35		12.4						3.1												15.5
.75					9.7	3.2	16.2	22.7				3.2								55.0
.80					5.9					5.9										11.8
113.30					1.8	3.6		1.8												7.2
.35	2.7																			2.7
.40				3.1	3.1															6.2
.45																3.2				3.2
.50			9.8		4.9		4.9													19.6
.55	2.9					2.9	2.9		5.8											14.5
.65		2.4				2.4														4.8
117.26			6.0	24.0	36.0	42.0	36.0													144.0
.30	94.9	6.8	20.4	27.2	13.6	13.6	27.1	27.2		6.8										237.6
.35	2.4	2.4	4.9	12.3	12.3	2.4	4.8		4.9											46.4
.40	32.6	81.6	39.5	13.6		6.8	2.8		2.8	1.4										181.1
.45							1.3		1.3	1.3										3.9
.50				3.1																3.1
.55	5.2					2.6														7.8
.60		2.5																		2.5
.65	2.4	2.4		2.4		2.4	2.4													12.0
.70					2.5															2.5
118.39	4.8				4.8	4.8														14.4

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5706 (cont'd):																				
119.33	5.5	2.7	5.5	13.7	19.2	16.5	8.2	2.7	5.5		2.7	2.7								84.9
120.25		32.8	68.0	128.5	189.0	131.0	68.1	40.4	25.2	17.7	2.5								20.2	723.4
.30		6.6	13.2	29.7	89.1	145.2	99.0	52.8	19.8	26.4	6.6									488.4
.35		10.3	34.2	109.4	355.6	820.8	776.3	352.3	153.9	188.1	102.6	44.5	17.1	6.8						2,971.9
.40		1.8		1.8	3.6		1.8													9.0
.45					3.2														3.2	6.4
.50									2.5											2.5
.65			3.4			3.4	3.4													10.2
.70		8.6	2.9																	11.5
123.37					4.3										2.2					6.5
130.30							2.6													2.6
.35	6.2							6.2												12.4
.40	28.1		3.1																	31.2
133.25		12.8	204.8	307.2	384.0	448.0	230.4	25.6												1,612.8
.30				13.6	13.6	13.6	13.6													54.4
.35				9.5	19.0		28.5	28.5												85.5
.40	2.7	2.7	16.0	10.6		2.7	2.7	2.7												40.1
137.23					41.9		41.9		41.9											125.7
.45	2.1																			2.1
143.40												3.8								3.8
Total	2969.3	2420.1	1477.6	1726.5	2387.1	2601.4	1970.7	1032.2	626.2	512.4	330.2	145.2	59.7	34.3	61.2	15.7	7.2	3.1*	26.4	18,406.5
Cruise 5707:																				
63.70																3.8				3.8
70.70															4.2					4.2
73.50												4.8								4.8
77.50				3.3	3.3															6.6
.70												3.8								3.8
80.51	7.8	10.4			2.6	7.8	13.0	15.6	7.8	10.4		2.6								78.0
.55			11.3	22.7	62.3	107.6	130.1	113.2	62.3	39.6	34.0	5.7								588.8
.60					12.9	6.4	25.8	32.2	19.3	19.3	38.7	6.4	19.3	6.4	6.4				12.9	206.0
82.47					2.6	2.6	2.6	2.6												10.4
83.40	36.0	24.4	17.4	29.0	53.4	39.5	25.5	19.7	5.8	1.2	1.2									253.1
.43	38.5	70.6	59.9	66.4	179.8	211.9	111.3	44.9	19.3	8.6	4.3									815.5
.51	2.4		2.4		2.4			2.4												9.6

* - 3.1 - 24.5 mm.

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5707 (cont'd):																				
83.55	8.6	2.8			2.8		2.8	8.5	2.8											28.3
.70															2.9					2.9
87.36	12.9	7.8	7.7	2.6																31.0
.45						5.4	16.2	21.6	16.2											59.4
.50	90.0	35.5	2.4	9.5	11.9	52.1	64.0	35.6	23.7	4.7		2.4								331.8
.55				8.6	17.1	14.3	8.6	20.0	11.4	2.9										82.9
.60					5.4		2.7	2.7	2.7	2.7								2.7		18.9
.90										28.0		27.9	28.0	14.0						97.9
90.30	21.0	2.6			2.6															26.2
.37	29.2	21.9	31.6	58.3	41.3	19.5	9.8	4.9		4.9		2.4	2.4	2.4						228.6
.45			4.7	42.3	42.3	32.9	98.7	84.6	42.3	47.0	23.5	32.9	9.4			4.7				465.3
.50				33.5					16.7	16.7	8.4									75.3
.55	2.4	4.7	14.1	23.6	26.0	23.6	7.1	7.1	2.4	7.1	23.6	7.1	2.4		2.4			7.2*		160.8
.60					2.3	2.3	4.6		2.3		2.3	7.0		7.0	11.6			2.3		41.7
.80													2.6							2.6
93.30	37.8	62.1	43.2	35.1	27.0	8.1														213.3
.35		2.6				2.6														5.2
97.30	14.0	2.0	2.0	4.0			2.0		2.0											26.0
.32		8.7	6.6		2.2															17.5
.40	329.8	59.5	16.1	9.2																414.6
100.32					2.8			2.8												5.6
.40	2.6	2.6				2.6														7.8
103.35			3.2																	3.2
.40	8.7	2.9																		11.6
.45	2.8																			2.8
107.32	3.7																			3.7
110.33	125.5	81.4	10.2	6.8	13.6	10.2	10.2	6.8	3.4											268.1
.35				6.0	14.8	17.8	5.9	8.9												53.4
113.30	2.1		2.1		2.1	4.1		4.1	10.3											24.8
.35	83.0	59.3	27.6	59.3	67.2	23.7	15.8													335.9
.40	3.2																			3.2
117.26			3.4					3.4												6.8
.30			3.6			3.6														7.2
.35		3.8	7.6																	11.4
.40		3.4	13.4	13.4	16.7	3.4				3.4										53.7
.50			3.3																	3.3

* - 4.8 - 23.25 mm.; 2.4 - 25.5 mm.

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5707 (cont'd):																				
119.33		3.4	17.2	27.5	10.3	10.3	10.3													79.0
120.30		48.4	87.2	113.1	129.2	64.6	38.8	3.2	6.4		3.2									494.1
.35		2.9	40.2	40.2	37.4	40.2	20.1	25.9	8.6	2.9										218.4
.40	3.8	22.7	24.5	20.7	32.1	15.2	15.1	7.6	1.9	7.6	1.9	7.6		1.9						162.6
.55	3.3																			3.3
.70					3.4			3.4												6.8
.75					3.4															3.4
123.37						2.9	2.9													5.8
.42							3.1													3.1
.50			2.9	17.5	23.2	29.2	2.9	2.9		2.9										81.5
.55				3.1	3.1															6.2
130.35					132.4	176.6	88.3	66.2		22.1	44.2		44.2							574.0
.40			6.6	191.4	475.2	580.8	198.0	33.0	6.6	13.2			6.6							1,511.4
.45	3.0	8.8	3.0	6.0	20.6	6.0														47.4
.50			3.1	3.1		6.2														12.4
133.35					3.4															3.4
.40	3.4	41.2	27.5	13.8																85.9
.50	165.6	148.8	74.4	44.0	33.8															466.6
137.45		3.3																		3.3
Total	1041.1	748.5	580.4	914.0	1524.9	1534.0	936.2	583.8	274.2	245.2	185.3	110.6	114.9	31.7	27.5	8.5		12.2	12.9	8,885.9
Cruise 5708:																				
110.33		2.8		2.8	2.8	2.8	8.4	8.4	2.8		2.8									33.6
.35	5.8	2.9		2.9	2.9	2.9	2.9	2.9												23.2
113.30	153.9	40.5	8.1	2.7	2.7	10.8	13.5	10.8	5.4											248.4
.35	2.7	10.7	31.9	8.0	13.3	10.6	13.3	26.6	13.3	2.7	2.7	2.7								138.5
115.27				5.8	11.6	2.9	17.4	14.5	8.7						2.9					63.8
.30		16.9	6.8	13.5	3.4			6.8	3.4											50.8
117.26				2.9		5.8	2.9	5.8	14.6	2.9				2.9						37.8
.30		8.8	14.7	8.8	32.2	90.9	175.8	164.1	90.8	43.9	5.9	5.8								641.7
.35	3.2				16.0	38.4	22.4	9.6	3.2	3.2										96.0
.40					2.7		2.7													5.4
118.25			6.0	3.0	3.0															12.0
.30							3.2													3.2
120.25			8.9	5.9	6.0		3.0			3.0										26.8
.30				3.3	3.3	3.3														9.9

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5708 (cont'd):																				
120.35				4.2	2.1	6.4	6.4	2.1												21.2
.40			2.0	6.1	4.1	4.1		4.1	2.0						2.0					24.4
.45			2.9																	2.9
127.40			3.4																	3.4
.45							2.8													2.8
Total	165.6	82.6	84.7	69.9	106.1	178.9	274.7	255.7	144.2	55.7	11.4	8.5		2.9	4.9					1,445.8
Cruise 5709:																				
110.33								2.4												2.4
.35										3.5										3.5
113.35								3.1												3.1
115.35																			5.8	5.8
117.35						3.0														3.0
.40	3.3			3.3			3.3		3.3											13.2
118.30						3.8														3.8
Total	3.3			3.3		6.8	3.3	5.5	3.3	3.5									5.8	34.8
Cruise 5710:																				
80.51						2.8	2.8	2.8									5.6			14.0
.60																2.7				2.7
82.47					3.5				3.5		3.5									10.5
83.40		2.6		1.3				2.6	1.3		1.3									9.1
.43		10.6	7.1	3.6	3.6		7.1	7.2	17.7	7.2										64.1
.70			2.4																	2.4
87.45								3.1												3.1
.50									6.4			3.2								9.6
90.30			3.4	3.4	16.8	10.1	16.8				3.4									53.9
.37					13.4	40.2	33.5	26.8	6.8	3.4										124.1
.50									1.4											1.4
93.27					2.8															2.8
.35						9.0		4.5												13.5
97.30	2.1					4.2		2.1												8.4
.32						7.6		7.5	3.8		7.5									26.4
.35	3.5						7.0			3.5										14.0
.40	10.2	13.6	34.0	23.8	23.8	37.4	27.2	3.4	6.8	3.4										183.6
100.30							3.2													3.2
.35									6.6											6.6

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5710 (cont'd):																				
103.30				2.6	18.3	49.8	55.0	60.3	26.2	7.8										220.0
.40		15.7	9.5																	25.2
110.33						3.0														3.0
113.30					2.8															2.8
117.26						9.0	18.0	6.0												33.0
.30							2.3													2.3
137.23			3.6	3.6	7.3	7.3														21.8
Total	15.8	42.5	60.0	38.3	92.3	180.4	172.9	126.3	80.5	25.3	15.7	3.2				2.7	5.6			861.5
Cruise 5711:																				
73.51					6.8	13.6	6.8		3.4		3.4									34.0
.55							6.3			3.2	3.2									12.7
80.55		15.3	39.8	116.3	97.9	79.6	67.3	52.0	61.2	39.8	12.3		6.2	6.2						593.9
.60			5.9	14.7	2.9	8.8	8.8	11.8	5.9	5.9	2.9				2.9					70.5
.70				2.8		2.8														5.6
82.47	4.7	56.1	70.2	70.2	60.8	51.5	56.2	23.4	23.4	18.7	4.7									439.9
83.40	4.5	20.3	27.1	18.1	2.3	2.3	4.6		4.6											83.8
.43		33.8	84.7	33.8	11.2	16.9	62.1	28.2	11.2	11.3	5.6									298.8
.51	6.6	13.3	19.9	23.3	29.9	16.6						3.3								112.9
.55		4.6	2.3					2.3	2.3											11.5
87.36		2.2	4.4	4.4				2.2	2.2											15.4
.50								6.4												6.4
.55				2.6																2.6
.60			11.5	19.2	11.5	11.5	3.8	3.8		3.8									3.8	68.9
90.28			16.6	49.8	49.7	33.2	66.3	33.2	27.6	33.2				11.1		5.5				326.2
.30			2.9	8.8	8.8	5.9	8.8		2.9	2.9										41.0
.37			17.4		11.6	7.8	5.8	1.9		1.9										46.4
93.27			8.4	2.8	2.8	5.6														19.6
.30								3.0												3.0
.35			2.3																	2.3
.60							4.0													4.0
97.30			12.6	21.0	8.4	8.4	8.4	12.6		4.2										75.6
.32		11.7		3.9		3.9														19.5
.40	10.2	35.6	15.3	10.2																71.3
.45																			3.7	3.7
.55			2.6																	2.6
Total	26.0	192.9	343.9	401.9	304.6	268.4	309.2	180.8	144.7	124.9	32.1	3.3	6.2	17.3	2.9	5.5			7.5	2,372.1

Table IV (cont'd)
Record of anchovy larvae, 1957

Station	Midpoint of size class (in mm.) 2.50	3.75	4.75	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.75	17.25	19.25	21.25	23.25	Dis.	Total
Cruise 5712:																				
80.51	164.5	96.1	7.6	10.2	2.5	7.6	2.5		2.5	2.5										296.0
.55	30.0	12.0	9.0	3.0	3.0															57.0
.60				7.3		18.3	3.7	7.4	7.4	3.7	11.0		3.7		3.7					66.2
.70				3.3																3.3
90.28	3.3	6.6	3.3																	13.2
.37		3.0	3.0																	6.0
97.32	15.8	28.5		6.3	3.2	6.3	3.2	3.2												66.5
Total	213.6	146.2	22.9	30.1	8.7	32.2	9.4	10.6	9.9	6.2	11.0		3.7		3.7					508.2

RECORD OF THE LARVAE OF THE JACK MACKEREL (TRACHURUS SYMMETRICUS), 1957

Jack mackerel larvae are recorded by size in table V. The data are summarized in text table 9, by month and area. The distribution and relative abundance of jack mackerel larvae in 1957 are illustrated in figure 5. Four categories of abundance are used in the chart. The value shown for a station is the cumulative standard haul total of jack mackerel larvae taken in all occupancies during the year.

The size groupings of larvae in table V have the following midpoints and ranges:

Midpoint (in mm.)	Range (in mm.)	Midpoint (in mm.)	Range (in mm.)
2.00	1.76-2.25	7.75	7.26-8.25
2.50	2.26-2.75	8.75	8.26-9.25
3.00	2.76-3.25	9.75	9.26-10.25
3.50	3.26-3.75	10.75	10.26-11.25
4.00	3.76-4.25	11.75	11.26-12.25
4.50	4.26-4.75	12.75	12.26-13.25
5.00	4.76-5.25	13.75	13.26-14.25
5.75	5.26-6.25	14.75	14.26-15.25
6.75	6.26-7.25	15.26 and over	

The relative abundance of jack mackerel larvae in different parts of the CCOFI survey area in 1957 is compared with their areal abundance during the preceding two years in the following summary:

	1955			1956			1957		
Lines	Occurrences	Number	Percent	Occurrences	Number	Percent	Occurrences	Number	Percent
60-77	22	660	5.0	20	992	11.5	29	2,740	13.7
80-93	83	5,716	43.2	39	1,198	14.9	82	7,174	35.9
97-107	118	4,192	31.6	81	3,556	44.3	130	9,488	47.4
110-120	121	2,457	18.5	67	2,285	28.5	47	602	3.0
123-137	25	221	1.7	8	66	0.8	1	3	0.01
140-157	0	0	0	0	0	0	0	0	0
Total	369	13,246	100.0	215	8,027	100.0	289	20,007	100.01

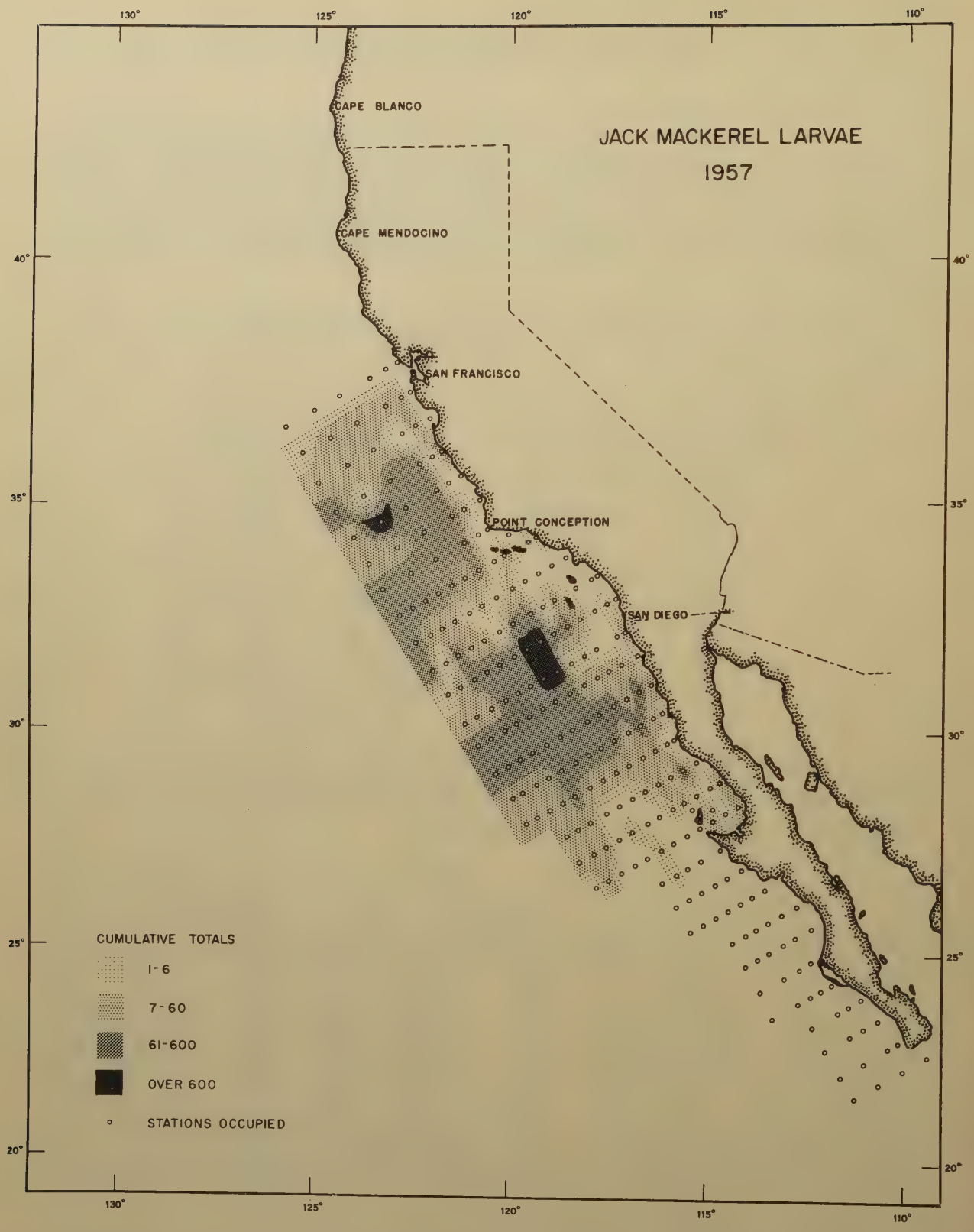


Figure 5.--Jack mackerel larvae, 1957: Distribution and relative abundance.

Text table 9.--Occurrence and abundance (standard haul totals) of jack mackerel larvae (Trachurus symmetricus), by month and area, in hauls made during 1957

Cruise	Central California 60-77		Southern California 80-93		Northern Baja California 97-107		Upper central Baja California 110-120		Lower central Baja California 123-137		Southern Baja California 140-157		Total	
	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber
5701	-	-	-	-	1	2	0	0	0	0	-	-	1	2
5702	-	-	0	0	9	562	1	3	0	0	0	0	10	565
5703	-	-	4	293	4	27	1	11	0	0	0	0	9	331
5704	-	-	5	378	22	735	10	187	1	3	0	0	38	1,303
5705	8	1,195	25	3,363	41	6,054	15	238	0	0	-	-	89	10,850
5706	16	1,467	27	2,778	38	1,863	9	80	0	0	0	0	90	6,188
5707	5	78	21	362	14	242	7	71	0	0	-	-	47	753
5708	-	-	-	-	-	-	2	8	0	0	-	-	2	8
5709	-	-	-	-	-	-	0	0	0	0	-	-	0	0
5710	-	-	0	0	1	3	2	4	0	0	-	-	3	7
5711	0	0	0	0	0	0	-	-	-	-	-	-	0	0
5712	-	-	0	0	0	0	0	0	-	-	-	-	0	0
Total	29	2,740	82	7,174	130	9,488	47	602	1	3	0	0	289	20,007
Percent		13.70		35.86		47.42		3.01		0.01		0		100.00

Data for the several years are only roughly comparable since the coverage was somewhat different in each year. Only a portion of the spawning range of the jack mackerel is surveyed on CCOFI cruises, and it is likely that a variable portion of the population is within the survey area in successive seasons. The most striking change in distribution of jack mackerel larvae in 1957 was the marked decrease in abundance off central and southern Baja California. Nearly 30 percent of jack mackerel larvae were taken in the area off central Baja California (station lines 110-137) in 1956, and over 20 percent in 1955, while only 3 percent occurred in this area in 1957. The northward shift in distribution of jack mackerel larvae is probably related to the warmer water temperatures prevailing in 1957.

The seasonal distribution of larger jack mackerel larvae (6.26 mm. and larger) during 1957 is compared with the distributions of the preceding five years in the following tabulation:

Seasonal abundance of larger jack mackerel larvae (6.26 mm. and over), 1952-1957 (standard haul totals)

Months	1952	1953	1954	1955	1956	1957
January	0	0	0	0	0	0
February	0	3	0	3	0	0
March	11	56	8	9	105	13
April	47	38	42	223	54	13
May	56	77	46	80	58	62
June	286	310	246	80	108	635
July	189	89	57	335	67	56
August	31	3	18	-	0	0
October	0	44	0	0	0	0
Total	620	620	417	730	392	779

There was a marked peak in the abundance of larger larvae in June, 1957. A similar pattern of seasonal abundance was found in 1952 through 1954. The seasonal distributions in 1955 and 1956 were bimodal, however; peaks in abundance of larger larvae occurred in April and July during 1955 and in March and June of 1956. The numbers of larger larvae taken in June 1957 were markedly greater than during any other one month, but the season total was not much larger than that for 1955.

Table V

Record of the larvae of jack mackerel (Trachurus symmetricus), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5701:																				
103.30		2.4																		2.4
Total		2.4																		2.4
Cruise 5702:																				
100.60	6.8	13.6	30.7	20.5																71.6
.70			43.4	14.5																57.9
.80	6.9	13.7	17.2	20.6	3.4															61.8
.90	7.4	3.7																		11.1
103.50				7.2																7.2
.70			12.9	25.8	19.4															58.1
107.50	16.3	27.2	81.6	97.9	16.3															239.3
.60			5.6	22.6	16.9	5.6														50.7
.70			2.3	2.3																4.6
110.50				2.7																2.7
Total	37.4	58.2	193.7	214.1	56.0	5.6														565.0
Cruise 5703:																				
83.60								5.9												5.9
.70				11.5	11.5	11.5														34.5
90.90		9.5	53.7	75.8	53.7	37.9	9.5	3.2	3.2											246.5
93.70										6.0										6.0
103.70			6.2																	6.2
107.35	3.2																			3.2
.60				3.8			3.8	3.8												11.4
.70	3.1				3.1															6.2
110.50			7.5								3.7									11.2
Total	6.3	9.5	67.4	91.1	68.3	49.4	13.3	12.9	3.2	6.0	3.7									331.1
Cruise 5704:																				
83.90		2.4																		2.4
90.45		39.5																		39.5
.80			49.6	86.8	24.8															161.2
93.50				14.9																14.9
.60		22.8	22.8	57.0	34.2	22.8														159.6

Table V (cont'd)
Record of the larvae of jack mackerel (Trachurus symmetricus), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5704 (cont'd):																				
97.45			6.1																	6.1
.60		12.8	76.8	179.2	128.0	25.6	12.8													435.2
100.40										4.9										4.9
.45		3.2																		3.2
.60			4.8	9.6	14.5	4.8		4.8												38.5
.70		7.0	31.7	21.1	12.3	5.3	3.5													80.9
.80	3.4	3.4	3.4	6.8																17.0
103.30		7.2	4.3																	11.5
.35						5.3	2.6	2.6												10.5
.40					5.6		2.8		2.8											11.2
.45		3.1		9.2	12.3	9.2	3.1													36.9
.50							2.7													2.7
.55		5.6			5.6															11.2
.60			3.4	10.2																13.6
.80		3.0	3.0	3.0																9.0
.90	3.1																			3.1
107.35		3.2																		3.2
.40				6.7	3.3			3.3												13.3
.45				2.8				2.8	2.8											8.4
.55				6.4																6.4
.60							3.5													3.5
.70							2.2	2.2												4.4
110.40								7.1												7.1
.60					7.7	3.9														11.6
.70			13.2	26.4	19.8	16.5	6.6													82.5
.90			3.4	6.7																10.1
113.35	15.8	4.0	4.0																	23.8
.45		5.7									2.8									8.5
.80				2.9	2.9															5.8
117.40						10.4														10.4
.70	2.7	8.0																		10.7
.80	7.3	2.4	2.4	4.8																16.9
123.55						2.6														2.6
Total	32.3	133.3	228.9	454.5	271.0	106.4	39.8	22.8	5.6	4.9	2.8									1,302.3

Table V (cont'd)

Record of the larvae of jack mackerel (Trachurus symmetricus), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5705:																				
70.52	14.1	14.1	28.2	21.1																77.5
.60		25.8	68.8	34.4																129.0
.70	8.9	53.4	93.4	71.2																226.9
.80	3.5																			3.5
.90		3.3																		3.3
73.60	36.5	77.5	145.9	95.8																355.7
.70	16.5	33.0	49.6	33.0																132.1
77.70	29.7	59.4	89.0	89.0																267.1
80.70		14.3	14.3	71.4																100.0
.90				3.6	11.0	7.3														21.9
83.60						2.9														2.9
.80	2.8																			2.8
.90		3.3		3.3	13.1		3.3	3.3	3.3	9.8	3.3									42.7
87.55	26.0	6.5																		32.5
.75	10.0	20.1																		30.1
.80	6.2	27.8	3.1																	37.1
.85	8.3	8.3																		16.6
.90			3.4		3.4															6.8
90.55	208.1	115.6																		323.7
.60	246.2	109.4	109.4																	465.0
.70			3.3																	3.3
.75	9.8	6.5																		16.3
.80								2.6	2.6											5.2
.90		12.1	9.1	3.0																24.2
93.40	32.3	35.0		2.7																70.0
.45	68.4	42.1	15.8																	126.3
.50	18.2	36.4	54.6																	109.2
.55	440.8	957.0	75.4																	1,473.2
.60	27.8	197.8	105.1	37.1	3.1															370.9
.65			5.1	25.6	5.1															35.8
.70	5.4	10.8	2.7	2.7		2.7														24.3
.75			10.7	5.4				2.7												18.8
.85	3.4																			3.4
97.30		8.9	4.5																	13.4
.55	155.5	699.8	959.0	233.3				13.0												2,060.6

Table V (cont'd)

Record of the larvae of jack mackerel (Trachurus symmetricus), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5705 (cont'd):																				
97.60		27.4	78.4	39.2	7.8	3.9	7.8	31.4	3.9											199.8
.65	8.7	26.1	110.2	29.0	2.9	8.7	5.8													191.4
.70		21.3	71.1	37.9	9.5	7.1	4.7	7.1												158.7
.75	16.8	23.4	10.0	13.4	13.4	6.7	6.7	6.7												97.1
.80					3.5															3.5
.90								1.9												1.9
100.29			4.5																	4.5
.33		8.5	8.5																	17.0
.45	2.8										2.8									5.6
.50	9.6	16.8	2.4																	28.8
.60		6.0	11.9		3.0															20.9
.65	6.0	15.0	72.2	63.2	15.0	9.0	9.0	9.0												198.4
.70	13.7	82.1	99.2	27.4	13.7	20.5	13.7	6.8		3.4										280.5
.75	6.8	27.4	68.4	20.5	11.4	18.2	16.0	4.6												173.3
.80	8.7	34.7	60.8	36.9	32.6	62.9	39.1	10.8												286.5
.85		3.4	13.7	17.1	13.7	13.7	6.8	3.4												71.8
.90		6.4	32.0	38.4	9.6	3.2	3.2	3.2												96.0
103.35		3.3	6.6	3.3																13.2
.45	2.6	10.2	17.9	12.8	5.1															48.6
.50	5.2	5.2	7.8																	18.2
.55		3.6	14.3	21.4	10.7	3.6														53.6
.60		6.9	10.4	10.4	13.9	10.4	3.5													55.5
.65		2.6	50.4	177.6	66.2	26.5	8.0	7.9	5.2	7.9	2.6									354.9
.70	6.4	12.8	28.9	44.9	16.0	3.2	3.2		3.2											118.6
.75		5.9	8.8	11.7	8.8			5.9												41.1
.80		20.6	27.4	13.7					3.4											65.1
.85		19.4	43.6	14.5																77.5
.90	5.4	10.8	81.0	89.1	29.7	13.5	5.4	2.7												237.6
107.35				4.2	12.6															16.8
.40		6.8	13.5	11.2	4.5															36.0
.50			29.9	24.9	19.9	5.0			2.5											82.2
.55	8.6	49.2	119.8	44.9	21.4	17.1	4.3	2.1	2.1											269.5
.60			161.1	127.2	33.9	17.0		8.5												347.7
.65		3.0	36.2	42.3	21.1			3.0												105.6
.70		9.4	61.4	75.5	14.2															160.5
.75			4.2	4.2				2.1												10.5
.80			3.2			3.2			3.2											9.6
.85		3.6				3.6														7.2
.90		2.9	5.8	2.9			2.9													14.5

Table V (cont'd)

Record of the larvae of jack mackerel (Trachurus symmetricus), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5705 (cont'd):																				
110.55	6.3	6.3																		12.6
.75	2.9																			2.9
.80	3.0	3.0	6.0	9.1																21.1
.85	2.8	2.8		2.8																8.4
.90					6.1															6.1
113.35		43.4	6.2	6.2	12.4															68.2
.40	6.1																			6.1
.50						2.6														2.6
.70		18.1	25.9	7.8	2.6															54.4
.80			3.0																	3.0
117.45	4.6																			4.6
.75	2.7	5.4	5.4								2.7									16.2
.80		16.1	5.4																	21.5
119.33	5.4																			5.4
120.75								5.0												5.0
Total	1513.5	3148.0	3277.8	1818.2	470.9	272.5	143.4	143.7	29.4	21.1	11.4									10,849.9
Cruise 5706:																				
63.70	6.7																			6.7
.80			3.6	3.6	3.6	3.6														14.4
.90							3.6													3.6
67.80	6.4	3.2																		9.6
.90	3.2	6.3	3.2																	12.7
70.60	6.3																			6.3
.90		16.5	22.0	27.5	22.0	11.0	5.5	11.0	5.5											121.0
73.60	12.1			12.1																24.2
.70		12.4	21.7	49.6	71.3	43.4	15.5	40.3	31.0	6.2	3.1									294.5
.80		21.6	33.9	138.6	224.8	194.0	61.6	27.8	9.3	6.2	3.1									720.9
.90				6.9	24.1															31.0
77.55			3.0	6.0				9.0		6.0										24.0
.60		6.4			6.4			19.2	6.4	6.4	6.4	12.8	6.4							70.4
.70						11.5		23.0	23.0	11.5										69.0
.80																			2.8	2.8
.90	3.1	18.7	6.2	9.3	3.1	3.1	6.2	3.1											3.1	55.9

Table V (cont'd)
Record of the larvae of jack mackerel (Trachurus symmetricus), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5706 (cont'd):																				
80.60		16.6	27.6			16.6		11.0	5.5											77.3
.70				26.3	39.5	65.8	39.5	79.0	26.4	13.2										289.7
.80	19.1	38.2	6.4	12.7	50.9	63.6	57.2	76.3	25.4	12.7										362.5
.90	33.2	78.5	27.2	33.2	30.2	24.2	9.1	18.2	6.0											259.8
83.60	3.4	6.9	27.4		3.4	10.3	6.9	20.6	34.3	27.5	3.4									144.1
.65		6.3				3.2	6.3		3.2											19.0
.70			9.0	24.0	36.0	33.0	9.0	21.0	3.0											135.0
.75				10.4	20.8		10.4		20.8											62.4
.80				32.3	19.4	64.6	32.3	13.0												161.6
.85	5.9	17.6	5.9	29.3	20.5	17.6	14.6	8.8												120.2
..90		3.0	11.8	8.8	3.0				3.0											29.6
87.65									11.0											11.0
.85		2.7	2.7																	5.4
.90				18.1	12.0	9.0		9.0	6.0	6.0										60.1
90.70			3.1	3.1						3.1		3.1								12.4
.75										15.0										15.0
.90				3.4					3.4	10.1		3.4		3.4						23.7
93.30	2.9																			2.9
.40											3.1									3.1
.55	32.8	45.9	39.4	3.3		3.3		23.0	9.9	3.3	3.3									164.2
.60		14.8	37.0	37.0	7.4				14.8											111.0
.65	157.8	161.5	33.0	18.4	40.4	36.7	25.7	14.7	11.0	7.3										506.5
.70		4.0	4.0																	8.0
.75	13.9	20.9	7.0																	41.8
.80	35.2	35.2	42.2	28.2																140.8
.85				7.1																7.1
.90					3.8															3.8
97.50											3.8									3.8
.55	6.6	6.6	6.6					6.6	19.7											46.1
.60	112.8	128.1	64.0	9.2	15.2	33.6	36.6	42.7	15.2	3.0	3.0									463.4
.65	14.2	49.6	35.4	17.7	7.1	7.1	21.2	3.5		3.5										159.3
.70			9.7	22.5	3.2	3.2														38.6
.75	9.3	6.2	28.0	96.4	21.8	12.4	6.2													180.3
.80		2.8		2.8	2.8	2.8														11.2
.85	3.0		3.0																	6.0
.90	6.1	6.1	3.0	6.1																21.3

Table V (cont'd)

Record of the larvae of jack mackerel (Trachurus symmetricus), 1957

Station	Midpoint of size class (in mm.)																	Dis.	Total
	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	
Cruise 5706 (cont'd):																			
100.40			3.9																3.9
.45		3.0																	3.0
.50	3.0	3.0	9.0						3.0										18.0
.55		6.6	9.9	23.2	6.6			19.8	23.1	9.9									99.1
.60	3.1	3.1		6.2	3.1	9.3	9.3	15.5	12.4										62.0
.65		8.1	27.0	16.2	16.2	5.4													72.9
.70				2.8	2.8		5.6												11.2
.75		3.0	15.2	15.2	3.0														36.4
.80													3.5						3.5
.85						3.1													3.1
.90			2.8	11.2		5.6	2.8			2.8									25.2
103.30	2.8																		2.8
.35	5.9	2.9	2.9	5.9		5.9	8.8	2.9	2.9	2.9									41.0
.40			3.8				7.6	15.3	7.6										34.3
.45				3.9	7.7	15.5	15.5	15.5	3.9	3.9									65.9
.50			3.4	6.7				6.8			3.4						3.4		23.7
.55			3.3	9.8	3.3		3.3		3.3										23.0
.60				10.1				10.1	13.4	3.4	3.4	3.4							43.8
.65		3.7	25.8	48.0	66.4	59.0	18.4	7.4	3.7				3.7					3.7	239.8
.70			3.3	16.4	13.2														32.9
.75	3.4		6.8	3.4															13.6
107.40			3.4				3.4	3.4					3.4						13.6
.50										2.9						2.9	2.9		8.7
.55										3.1		3.1							6.2
.60								3.4											3.4
.65				3.3					3.3										6.6
.70	3.2		3.2		3.2		3.2	3.2											16.0
.75	3.1			3.1			3.1	6.2											15.5
.80			3.6																3.6
110.45		3.0	6.1																9.1
.65					2.5														2.5
.75					3.2														3.2
.80			5.9																5.9

Table V (cont'd)

Record of the larvae of jack mackerel (Trachurus symmetricus), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5706 (cont'd)																				
113.75				2.5	2.5	5.1	2.5													12.6
.80			15.1	10.1		10.1														35.3
117.35				2.4																2.4
120.55		2.3																		2.3
.75				3.5			3.5													7.0
Total	518.5	775.3	681.4	907.8	826.4	792.6	454.4	590.3	370.4	169.9	36.0	25.8	17.0	3.4		2.9	6.3	3.7	5.9	6,188.0
Cruise 5707:																				
63.55									20.2											20.2
.60		14.3																		14.3
67.55	6.4	6.4	12.7	6.4																31.9
.70						8.0														8.0
77.80		3.6																		3.6
80.60			6.4		6.4															12.8
.70					14.9															14.9
.90					2.7															2.7
83.40		1.2																		1.2
.51	2.4	2.4		2.4			2.4													9.6
.70			5.8																	5.8
.85													2.8							2.8
87.75													3.8							3.8
90.75								4.8												4.8
.80	2.6																	2.6		5.2
.90	10.6	10.6	5.3	15.8		10.6		10.6												63.5
93.40								2.9												2.9
.45			4.4	4.4	2.2															11.0
.50	2.8				2.8	2.8														8.4
.55		12.0	15.0	18.0	15.0	6.0														66.0
.60	2.3		2.3	11.6	4.7															20.9
.65	2.2	8.9	2.2	2.2	2.2															17.7
.70		3.8	19.2	26.9		3.8	3.8	3.8	3.8											65.1
.75	3.6	10.7	3.6		3.6															21.5
.80	5.2	5.2	2.6		2.6															15.6
.85	2.8	2.8																		5.6
97.55		5.7	2.9																	8.6
.60		17.0	12.2	4.9	2.4		4.9					2.4								43.8

Table V (cont'd)

Record of the larvae of jack mackerel (Trachurus symmetricus), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5707 (cont'd):																				
97.65	5.2	2.6						2.6												10.4
.70		3.0		5.9	35.4	11.8	8.8													64.9
.75					5.7	8.6	2.8													17.1
.90		7.5	5.0																	12.5
100.50								2.8												2.8
.55								2.6		2.6										5.2
.60		2.7	5.4						2.7											10.8
103.50									2.5	2.5	5.0		2.5	2.5						15.0
.55			5.1	12.8	2.6															20.5
.60			2.7																	2.7
107.32		3.7																		3.7
.65	3.4	3.4	3.4	3.4	6.7	3.4														23.7
110.65		13.0	4.3	4.3	8.7															30.3
.70						3.4														3.4
.85	3.3																			3.3
117.26		6.8																		6.8
.40		3.4																		3.4
120.25	11.9	3.0																		14.9
.35							2.9	5.8												8.7
Total	64.7	153.7	120.5	119.0	118.6	58.4	25.6	35.9	29.2	5.1	5.0	2.4	9.1	2.5				2.6		752.3
Cruise 5708:																				
110.35				2.9																2.9
113.35				2.7		2.7														5.4
Total				5.6		2.7														8.3
Cruise 5709:																				0
Cruise 5710:																				
103.60						3.2														3.2
117.60								2.0												2.0
120.35		2.3																		2.3
Total		2.3				3.2		2.0												7.5
Cruise 5711:																				0
Cruise 5712:																				0

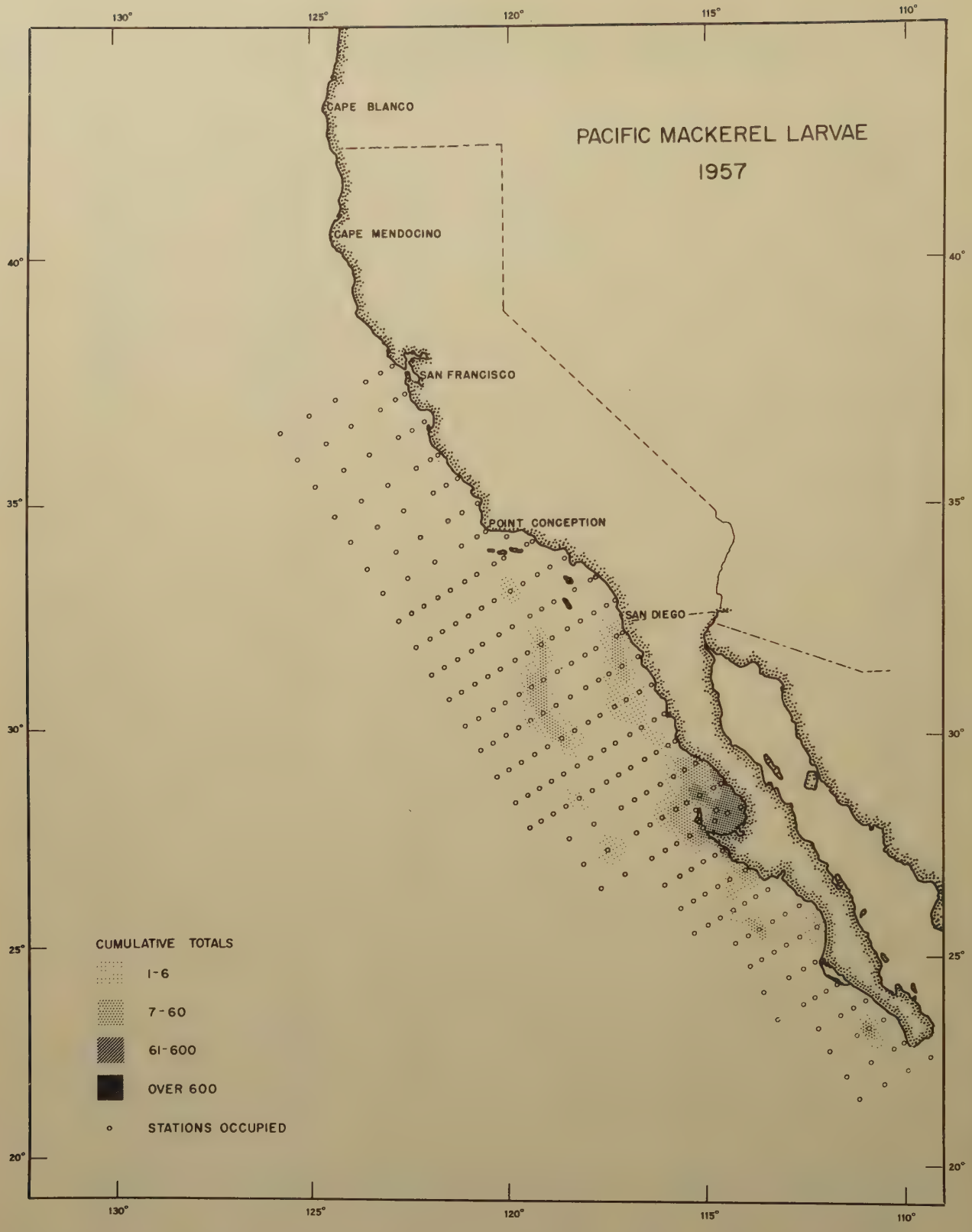


Figure 6.--Pacific mackerel larvae, 1957: Distribution and relative abundance.

RECORD OF THE LARVAE OF THE PACIFIC MACKEREL (PNEUMATOPHORUS DIEGO), 1957

The distribution and abundance of Pacific mackerel larvae in 1957 are illustrated in figure 6. For uniformity, the same categories of abundance are used in the distribution of Pacific mackerel larvae as in the other larval charts included in this report. The values at an individual station represent the cumulative standard haul total for all occupancies during the year.

The larvae of Pacific mackerel are reported by size in table VI; the size categories are identical to those used for jack mackerel (see p. 59 for midpoints and ranges). The data are summarized by month and area in text table 10.

Pacific mackerel larvae ranked eighteenth in abundance during 1957; thus it is one of the less abundant kinds in the CCOFI area. The number of larvae taken during a season has been fairly constant during the past three years, as is shown in the following tabulation:

	1955			1956			1957		
Lines	Occurrences	Number	Percent	Occurrences	Number	Percent	Occurrences	Number	Percent
60-77	0	0	0	0	0	0	0	0	0
80-93	7	136	7.0	3	23	1.5	2	19	1.0
97-107	20	152	7.8	11	365	24.0	16	102	5.5
110-120	40	1,218	62.4	21	1,090	71.8	49	1,608	86.2
123-137	19	289	14.8	4	38	2.5	8	108	5.8
140-157	6	155	7.9	1	3	0.2	1	28	1.5
Total	92	1,950	99.9	40	1,519	100.0	76	1,865	100.0

In the regular CCOFI survey area most Pacific mackerel larvae are taken off central Baja California, especially between lines 110 and 120. During 1957, less than 7 percent of the larvae were taken to the north of this area, a lesser percentage than in 1955 or 1956. Over three-fourths of the larvae were obtained in Sebastian Viscaino Bay, mainly during July through October.

Four cruises were made into the Gulf of California during 1957. Pacific mackerel larvae taken on these cruises will be dealt with in a separate report, but it should be noted that larvae of this species were much more abundant in the Gulf than on the outer coast.

Text table 10.—Occurrence and abundance (standard haul totals) of Pacific mackerel larvae (Pneumatophorus diego), by month and area, in hauls made during 1957

Cruise	Central California 60-77		Southern California 80-93		Northern Baja California 97-107		Upper central Baja California 110-120		Lower central Baja California 123-137		Southern Baja California 140-157		Total	
	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber
5701	–	–	–	–	0	0	0	0	1	6	–	–	1	6
5702	–	–	0	0	0	0	1	6	0	0	1	28	2	34
5703	–	–	0	0	1	10	0	0	0	0	0	0	1	10
5704	–	–	0	0	4	41.	1	3	0	0	0	0	5	44
5705	0	0	0	0	8	43	3	32	0	0	–	–	11	75
5706	0	0	1	16	2	6	7	188	0	0	0	0	10	210
5707	0	0	1	3	1	2	7	170	3	16	–	–	12	191
5708	–	–	–	–	–	–	18	654	2	8	–	–	20	662
5709	–	–	–	–	–	–	8	257	2	78	–	–	10	335
5710	–	–	0	0	0	0	4	298	0	0	–	–	4	298
5711	0	0	0	0	0	0	–	–	–	–	–	–	0	0
5712	–	–	0	0	0	0	0	0	–	–	–	–	0	0
Total	0	0	2	19	16	102	49	1,608	8	108	1	28	76	1,865
Percent		0		1.02		5.47		86.22		5.79		1.50		100.00

Table VI

Record of the larvae of Pacific mackerel (Pneumatophorus diego), 1957

Station	Midpoint of size class (in mm.)																	Dis.	Total
	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	
Cruise 5701:																			
127.40								5.5											5.5
Total								5.5											5.5
Cruise 5702:																			
120.25	6.0																		6.0
150.25						9.2	9.2	6.2	3.1										27.7
Total	6.0					9.2	9.2	6.2	3.1										33.7
Cruise 5703:																			
103.35			5.8																5.8
.40						4.0													4.0
Total			5.8			4.0													9.8
Cruise 5704:																			
97.32			17.0																17.0
100.33			5.2	10.4															15.6
.40					4.9														4.9
107.40					3.3														3.3
110.70				3.3															3.3
Total			22.2	13.7	8.2														44.1
Cruise 5705:																			
97.30			4.5																4.5
.60			3.9																3.9
.65			2.9																2.9
100.65		3.0	6.0	3.0															12.0
.70		3.4																	3.4
103.45			2.6																2.6
.60				3.5															3.5
.65				5.3	2.6	2.6													10.5
117.45		2.3	2.3																4.6
.50		2.8	2.8																5.6
119.33	21.4																		21.4
Total	21.4	11.5	25.0	11.8	2.6	2.6													74.9

Table VI (cont'd)
Record of the larvae of Pacific mackerel (Pneumatophorus diego), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5706:																				
93.55			13.1							3.3										16.4
97.60									3.0											3.0
.65				3.5																3.5
117.35		24.5	68.6	29.4	4.9		2.4													129.8
.40					1.4	2.7														4.1
.45	17.9	23.0	2.6																	43.5
.70									2.5											2.5
119.33		2.7																		2.7
120.25				2.5																2.5
.45				3.2																3.2
Total	17.9	50.2	84.3	38.6	6.3	2.7	2.4		5.5	3.3										211.2
Cruise 5707:																				
87.55										2.9										2.9
97.32				2.2																2.2
113.35					7.9															7.9
.40		6.4																		6.4
117.30			3.6																	3.6
120.25	3.0	3.0	11.9	5.9		3.0	3.0	3.0	3.0											35.8
.30	9.7	19.4	9.7	6.5	3.2		3.2													51.7
.35			2.9	5.7	8.6	5.7	5.7	8.6	11.5			2.9								51.6
.40	1.9	5.7	1.9			1.9		1.9												13.3
123.37										2.9										2.9
130.45		3.0	3.0																	6.0
133.40			3.4	3.4																6.8
Total	14.6	37.5	36.4	23.7	19.7	10.6	11.9	13.5	14.5	5.8		2.9								191.1
Cruise 5708:																				
110.35								2.9												2.9
113.30			5.4		2.7	5.4	5.4													18.9
115.27					2.9	2.9	11.6	11.6	14.4	2.9										46.3
.30							3.4													3.4
.35				2.8		2.8		2.8		2.8										11.2
117.26					2.9	8.8	5.8	38.0	55.4	17.5	2.9	5.8								137.1
.30			2.9	2.9		2.9	5.9	14.7	14.7	8.8										52.8

Table VI (cont'd)

Record of the larvae of Pacific mackerel (Pneumatophorus diego), 1957

Station	Midpoint of size class (in mm.) 2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.75	6.75	7.75	8.75	9.75	10.75	11.75	12.75	13.75	14.75	15.26 and over	Dis.	Total
Cruise 5708 (cont'd):																				
117.35						6.4	6.4	22.4	9.6	6.4										51.2
.40								2.7												2.7
118.25	9.1	6.0	6.0	3.0																24.1
.30				3.2			3.2			3.2										9.6
.35	6.2	25.0																		31.2
119.33		5.8	5.8	2.9	8.7	14.5	11.6	23.2	2.9	2.9										78.3
120.25	3.0		5.9	11.8	8.9	3.0	3.0		3.0		3.0									41.6
.30					3.3	13.4		6.7			3.3									26.7
.35				2.1	4.3	2.1	6.4	2.1			2.1									19.1
.40			2.0	6.1	4.1	14.2	12.2	30.4	16.3	4.0	2.0									91.3
.45					2.9	2.9														5.8
127.34							2.9	2.9												5.8
137.23					2.7															2.7
Total	18.3	36.8	28.0	34.8	43.4	79.3	77.8	160.4	116.3	48.5	13.3	5.8								662.7
Cruise 5709:																				
113.30									4.7	2.4										7.1
117.26							2.6	2.6	2.6											7.8
118.25								2.5												2.5
.30		22.5	3.8	18.8	22.5	37.5	22.5	26.3	3.8										3.8	161.5
119.33	6.0	3.0		14.9	8.9	3.0		3.0			3.0		3.0							44.8
120.30		3.1					3.1	3.1												9.3
.35	3.0	3.0		6.0				3.0				3.0								18.0
.40									3.0	3.0										6.0
123.37	3.4	3.4	10.1	20.2	23.6	13.5														74.2
127.34						3.4														3.4
Total	12.4	35.0	13.9	59.9	55.0	57.4	28.2	40.5	14.1	5.4	3.0	3.0	3.0						3.8	334.6
Cruise 5710:																				
117.26			3.0	3.0			3.0													9.0
119.33		2.6	7.8	7.8	10.4	7.8	2.6	2.6	2.6											44.2
120.30	8.4	21.1	29.5	33.8	25.3	8.4	2.1													128.6
.35	2.3	13.6	34.0	38.6	20.4	6.8														115.7
Total	10.7	37.3	74.3	83.2	56.1	23.0	7.7	2.6	2.6											297.5
Cruise 5711:																				0
Cruise 5712:																				0

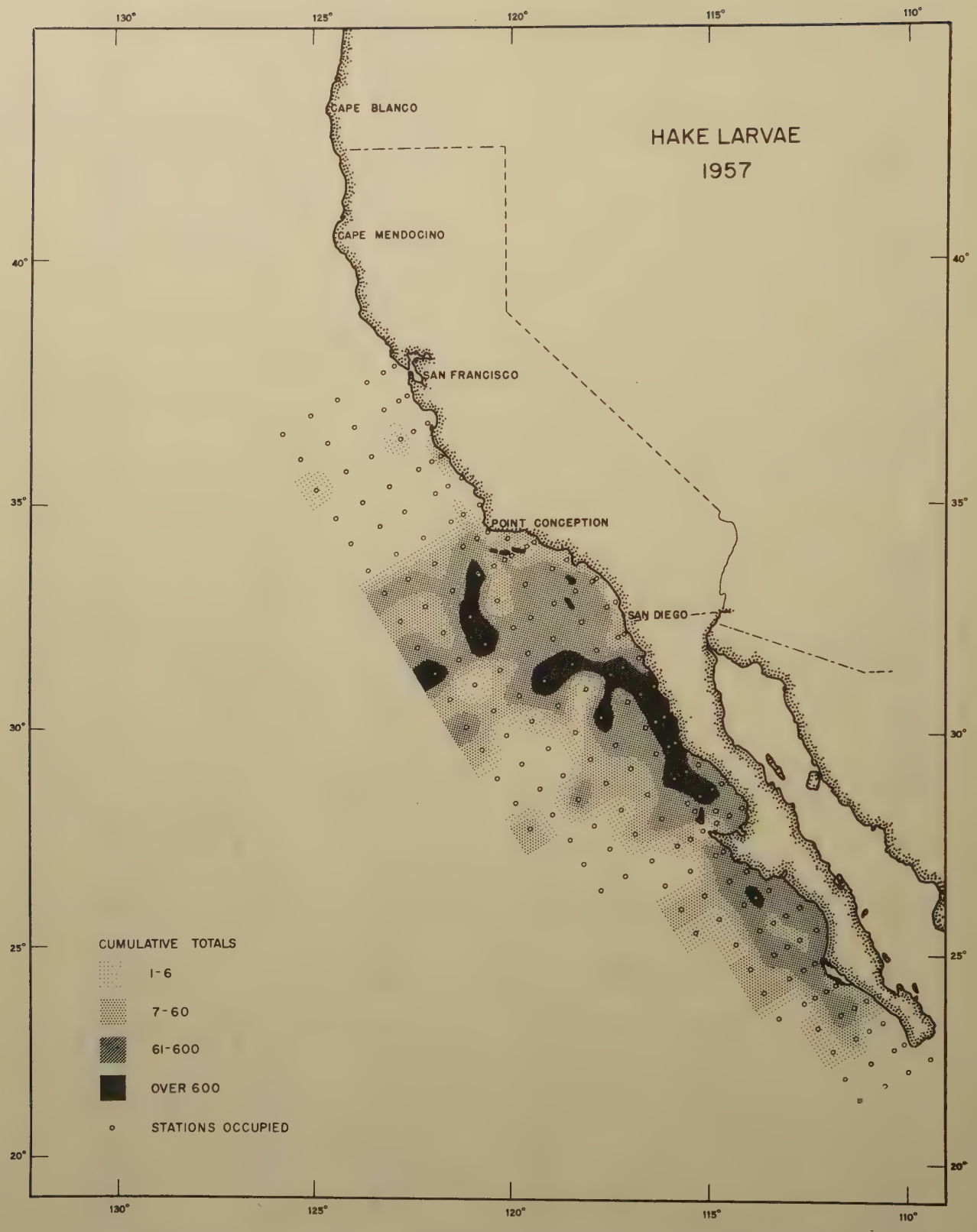


Figure 7.--Hake larvae, 1957: Distribution and relative abundance.

RECORD OF THE LARVAE OF HAKE (MERLUCCIUS PRODUCTUS), 1957

The records of hake larvae contained in table VII are the numbers of larvae (standard haul totals) taken in each plankton collection made in 1957. Length measurements were not made on hake larvae. The distribution and relative abundance of hake larvae in 1957 are shown in figure 7. The basic data contained in table VII are summarized by month and area in text table 11.

Hake larvae constituted 16 percent of the fish larvae taken on CCOFI cruises during 1957. They were exceeded in abundance only by anchovy larvae, as was also the situation during each of the preceding five years (1952–1956). Monthly abundance and occurrences of hake larvae in 1957 are compared with similar data for 1956 in the following summary:

Monthly abundance of hake larvae in 1956 and 1957

	1956			1957		
Months	Occurrences	Standard haul totals	Percent of total	Occurrences	Standard haul totals	Percent of total
January	47	33,376	37.14	19	1,278	1.63
February	74	39,746	44.23	67	37,998	48.54
March	111	15,010	16.70	98	34,589	44.18
April	64	1,047	1.17	81	4,047	5.17
May	32	301	0.33	62	260	0.33
June	16	195	0.22	16	88	0.11
July	7	90	0.10	4	16	0.02
August	3	47	0.05	1	3	0.01
September	0	0	0	0	0	0
October	1	6	0.01	0	0	0
November	0	0	0	1	4	0.01
December	5	39	0.04	0	0	0
Total	360	89,857	99.99	349	78,283	100.00

Most hake larvae were taken during a two-month period, February and March. Due to the abbreviated coverage in January 1957 (only 57 stations occupied, all off Baja California), hake abundance must be underestimated for this month. Over 40 percent of the larvae were taken off California (station lines 60–93) in 1957, as compared to less than 3 percent in this area in 1956 and approximately 8 percent in 1955.

Text table 11.--Occurrence and abundance (standard haul totals), of hake larvae (Merluccius productus), by month and area, in hauls made during 1957

Cruise	Central California 60-77		Southern California 80-93		Northern Baja California 97-107		Upper central Baja California 110-120		Lower central Baja California 123-137		Southern Baja California 140-157		Total	
	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber
5701	-	-	-	-	0	0	8	965	11	313	-	-	19	1,278
5702	-	-	8	377	18	24,517	16	10,233	16	1,385	9	1,486	67	37,998
5703	-	-	31	28,712	14	773	20	3,482	22	1,254	11	368	98	34,589
5704	-	-	35	2,731	21	806	15	431	7	58	3	21	81	4,047
5705	2	11	23	128	14	93	4	21	2	7	-	-	45	260
5706	2	6	3	16	9	58	2	8	0	0	0	0	16	88
5707	0	0	0	0	0	0	3	13	1	3	-	-	4	16
5708	-	-	-	-	-	-	1	3	0	0	-	-	1	3
5709	-	-	-	-	-	-	0	0	0	0	-	-	0	0
5710	-	-	0	0	0	0	0	0	0	0	-	-	0	0
5711	0	0	1	4	0	0	-	-	-	-	-	-	1	4
5712	-	-	0	0	0	0	0	0	-	-	-	-	0	0
Total	4	17	101	31,968	76	26,247	69	15,156	59	3,020	23	1,875	332	78,283
Percent		0.02		40.84		33.53		19.36		3.86		2.40		100.01

Table VII

Record of the larvae of hake (Merluccius productus), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
60.50	-	-	-	-			NQ	-	-	-	-	-
.55	-	-	-	-				-	-	-	-	-
.60	-	-	-	-				-	-	-	-	-
.70	-	-	-	-				-	-	-	-	-
.80	-	-	-	-			-	-	-	-	-	-
.90	-	-	-	-			-	-	-	-	-	-
63.52	-	-	-	-				-	-	-	-	-
.55	-	-	-	-				-	-	-	-	-
.60	-	-	-	-				-	-	-	-	-
.70	-	-	-	-				-	-	-	-	-
.80	-	-	-	-				-	-	-	-	-
.90	-	-	-	-	-		-	-	-	-	-	-
67.50	-	-	-	-			NS	-	-	-	-	-
.55	-	-	-	-				-	-	-	-	-
.60	-	-	-	-	4			-	-	-	-	-
.70	-	-	-	-				-	-	-	-	-
.80	-	-	-	-				-	-	-	-	-
.90	-	-	-	-	-	3	-	-	-	-	-	-
70.52	-	-	-	-	7			-	-	-	-	-
.55	-	-	-	-				-	-	-		-
.60	-	-	-	-				-	-	-		-
.70	-	-	-	-				-	-	-		-
.80	-	-	-	-			-	-	-	-		-
.90	-	-	-	-			-	-	-	-	-	-
73.50	-	-	-	-				-	-	-		-
.55	-	-	-	-				-	-	-		-
.60	-	-	-	-				-	-	-		-
.70	-	-	-	-				-	-	-	-	-
.80	-	-	-	-			-	-	-	-	-	-
.90	-	-	-	-	-		-	-	-	-	-	-
77.50	-	-	-	-				-	-	-	-	-
.55	-	-	-	-		3		-	-	-	-	-
.60	-	-	-	-				-	-	-	-	-
.70	-	-	-	-				-	-	-	-	-
.80	-	-	-	-				-	-	-	-	-
.90	-	-	-	-	-			-	-	-	-	-

Table VII (cont'd)

Record of the larvae of hake (Merluccius productus), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
80.51	-		6					-	-		-	
.55	-		212	15				-	-			
.60	-		133			6		-	-			
.70	-			26				-	-			
.80	-		168	9				-	-	NS	-	
.90	-		59	6	4			-	-		-	
82.47	-		11	5				-	-			-
83.40	-			16				-	-			-
.43	-		3					-	-			-
.48	-	-	20	-	-	-	-	-	-	-	-	-
.51	-		-	5			NS	-	-			-
.52	-		130	-	-	-	-	-	-	-	-	-
.55	-	-	-	-	7	3		-	-	-		-
.60	-		706	52	6			-	-			-
.65	-	-	-	-	-			-	-	-	-	-
.70	-	-	57	30				-	-		-	-
.75	-	-	-	-	-			-	-	-	-	-
.80	-	-	-	48	6			-	-		-	-
.85	-	-	-	-	-			-	-	-	-	-
.90	-	-	-	9	3		NS	-	-		-	
86.46	-		-	15	-	-	-	-	-	-	-	-
87.35	-	16	6	8				-	-			-
.38	-		-	-	-	-	-	-	-	-	-	-
.40	-	98	11	49			NS	-	-			-
.45	-	-	44	-				-	-			-
.50	-		23	193				-	-			-
.55	-		-	-				-	-			-
.60	-			12				-	-		4	-
.65	-	-	-	-				-	-	-	-	-
.70	-		341	284	3			-	-		-	-
.75	-	-	-	-	7			-	-	-	-	-
.80	-	-	-	13	12		NS	-	-		-	-
.85	-	-	-	-	11			-	-	-	-	-
.90	-	-	-	101	3			-	-		-	
90.28	-	6	16	28				-	-			
.30	-		60	8				-	-			
.37	-		72					-	-			
.45	-		12	53		7		-	-			

Table VII (cont'd)

Record of the larvae of hake (Merluccius productus), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
90.50	-	-	-	-	3			-	-			
.55	-	36	49	217				-	-			
.60	-	18	490	88				-	-			
.65	-	-	-	-				-	-	-	-	-
.70	-		24718	336	3			-	-		-	
.75	-	-	-	-				-	-	-	-	-
.80	-		160	12				-	-		-	
.85	-	-	-	-				-	-	-	-	-
.90	-		976	99	6			-	-		-	
93.27	-		15					-	-			-
.30	-	43	24	150	2			-	-			-
.35	-	-	-	62	2			-	-			-
.40	-	111	45	60	11			-	-			-
.45	-	-	-	62	3			-	-	-		-
.50	-	49	18	358	9			-	-			-
.55	-	-	-	197	6			-	-	-		-
.60	-		91	80				-	-			-
.65	-	-	-	-	10			-	-	-	-	-
.70	-		36		5			-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-	-	-	NS				-	-		-	-
.85	-	-	-	-	3			-	-	-	-	-
.90	-	-	-	25	3			-	-		-	-
97.30	-	11	5	3				-	-			-
.32	-		-	28				-	-			
.35	-	-	-	-	-	-	-	-	-		-	-
.40	-	80	9					-	-			-
.45	-	-	-	12				-	-	-		-
.50	-	1508	393	NS	3			-	-			-
.55	-	-	-	NS				-	-	-		-
.60	-	1529	-	77				-	-			-
.65	-	-	-	-				-	-	-	-	-
.70	-	76	-	3				-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-	-	-		7			-	-		-	-
.85	-	-	-	-				-	-	-	-	-
.90	-	-	-	61				-	-		-	-

Table VII (cont'd)

Record of the larvae of hake (Merluccius productus), 1957

Station	Cruise and month 5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
100.29	-	328	10	52	4			-	-		-	-
.30	-	-	-	-	-	-	-	-	-		-	-
.33	-	907	14	52				-	-	-	-	-
.35	-	-	-	-	-	-	-	-	-		-	-
.40	-	941	21	74				-	-		-	
.45	-	-	-	25		12		-	-	-	-	-
.50	-				5			-	-		-	-
.55	-	-	-	17				-	-	-	-	-
.60		24	3	39				-	-		-	-
.65	-	-	-	-	3			-	-	-	-	-
.70	-		-	5			-	-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-		-				-	-	-		-	-
.85	-	-	-	-			-	-	-	-	-	-
.90	-		-	16			-	-	-		-	-
103.30		884	88	76		3		-	-		-	-
.35		12096	72		10	6		-	-		-	-
.38		157	-	-	-	-	-	-	-	-	-	-
.40		232	8		17	12		-	-		-	-
.45	-	-	-		5	8		-	-	-	-	-
.50		948	9	3				-	-		-	
.55	-	-	-					-	-	-	-	-
.60			NS		4	3		-	-		-	-
.65	-	-	-	-	11	4		-	-	-	-	-
.70	-							-	-		-	-
.75	-	-	-	-		3		-	-	-	-	-
.80	-	-	-				-	-	-		-	-
.85	-	-	-	-			-	-	-	-	-	-
.90	-	-	-				-	-	-	-	-	-
107.32		4196*	123	38		-		-	-	NQ	-	-
.35				32	8			-	-		-	-
.40		289	15	110				-	-		-	-
.45	-	-	-	80	3			-	-	-	-	-
.50		294	3		2			-	-		-	-
.55	-	-	-	3	11			-	-	-	-	-
.60		17				7		-	-		-	
.65	-	-	-	-				-	-	-	-	-
.70	-							-	-		-	-

* - Samples combined. Values adjusted accordingly.

Table VII (cont'd)

Record of the larvae of hake (Merluccius productus), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
107.75	-	-	-	-				-	-	-	-	-
.80	-	-	-					-	-		-	-
.85	-	-	-	-				-	-	-	-	-
.90	-	-	-					-	-	-	-	-
110.33	-	3633	14	21							-	-
.35	-	1545	260	13	6						-	-
.40		162	7	56							-	-
.45	-	-	-	27				-	-	-	-	-
.50		3	15	9	3			-	-		-	-
.55	-	-	-	3				-	-	-	-	-
.60			8	16				-	-		-	-
.65	-	-	-	-				-	-	-	-	-
.70	-			241				-	-		-	
.75	-	-	-	-				-	-	-	-	-
.80	-		-					-	-		-	-
.85	-	-	-	-				-	-	-	-	-
.90	-	12	-	3				-	-	-	-	-
113.30	40	97	23	9	9						-	-
.35	16	370	571	4							-	-
.40		20	602	6							-	-
.45	-	-	-					-	-	-	-	-
.50			30					-	-		-	-
.55	-	-	-					-	-	-	-	-
.60			3					-	-		-	-
.65	-	-	-	-				-	-	-	-	-
.70								-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-	-	-					-	-		-	-
.85	-	-	-	-	-		-	-	-	-	-	-
.90	-	-	-	-	-		-	-	-	-	-	-
115.27	-	-	-	-	-	-	-			-	-	-
.30	-	-	-	-	-	-	-			-	-	-
.35	-	-	-	-	-	-	-			-	-	-
.40	-	-	-	-	-	-	-			-	-	-
117.26		396	3			6					-	-
.30	148	2441	425	19			4				-	-
.35	619	961	607					3			-	-
.40		53	33								-	-

Table VII (cont'd)

Record of the larvae of hake (Merluccius productus), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
117.45	-	-	-					-	-	-	-	-
.50	3	11	237					-	-		-	-
.55	-	-	-					-	-	-	-	-
.60			15					-	-		-	-
.65	-	-	-	-				-	-	-	-	-
.70								-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-	-	-					-	-		-	-
.85	-	-	-	-	-		-	-	-	-	-	-
.90	-	-	-	-	-		-	-	-	-	-	-
118.39	-	-	115		3			-	-		-	-
118.25	-	-	-	-	-	-	-			-	-	-
.30	-	-	-	-	-	-	-			-	-	-
.35	-	-	-	-	-	-	-			-	-	-
119.33	-	-	376								-	-
120.25	9	161	30	2		2					-	-
.30	94	363	108				6				-	-
.35		5					3				-	-
.40				-							-	-
.45	36		-	-							-	-
.50			-	2				-	-		-	-
.55			-					-	-	-	-	-
.60								-	-		-	-
.65	-	-	-	-				-	-	-	-	-
.70								-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-							-	-		-	-
.85	-	-	-	-	-		-	-	-	-	-	-
.90	-	-	-	-	-		-	-	-		-	-
123.37	7	236	143								-	-
.42	3	3	126		3						-	-
.45	-	-	-	-	-	-	-			-	-	-
.50					-			-	-		-	-
.55	-				-			-	-	-	-	-
.60					-			-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	-		-	-		-	-		-	-

Table VII (cont'd)

Record of the larvae of hake (Merluccius productus), 1957

	Cruise and month											
	5701	5702	5703	5704	5705	5706	5707	5708	5709	5710	5711	5712
Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
127.34		21	186								-	-
.40	11	84	8								-	-
.45	-	60	22	9	4						-	-
.50		5	6		-			-	-		-	-
.55	-		7		-			-	-	-	-	-
.60			38		-			-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	-		-	-		-	-		-	-
130.30		6	64								-	-
.35	53	558	12								-	-
.40	116	190	16								-	-
.45	-	-	-		-					-	-	-
.50	3		3					-	-		-	-
.55	-	-	-		-		3	-	-	-	-	-
.60			3					-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	-		-	-		-	-		-	-
133.25	50		92								-	-
.30	11	38	98	19							-	-
.35	6	-	35		-			-	-		-	-
.40	5	8	40	12				-	-		-	-
.45	-	-	-		-			-	-	-	-	-
.50	-			3				-	-		-	-
.55	-	-	-		-	-	-	-	-	-	-	-
.60	-	-	-		-	-		-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	-		-	-		-	-		-	-
137.23		26	29	7							-	-
.30		10	8	3							-	-
.35	48	113	134	-	-			-	-		-	-
.40	-	22	178		NS			-	-		-	-
.45	-	-	-	5	-			-	-	-	-	-
.50	-	5	6					-	-		-	-
.55	-	-	-		-	-	-	-	-	-	-	-
.60	-	-	-		-	-		-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	-		-	-		-	-		-	-

Table VII (cont'd)

Record of the larvae of hake (Merluccius productus), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
140.30	-	432	8		-		-	-	-	-	-	-
.35	-	355	11		-		-	-	-	-	-	-
.40	-	8	16		-		-	-	-	-	-	-
.45	-	-	-		-	-	-	-	-	-	-	-
.50	-	20	3		-		-	-	-	-	-	-
.55	-	-	-		-	-	-	-	-	-	-	-
.60	-	-	-		-	-	-	-	-	-	-	-
.70	-	-	-		-	-	-	-	-	-	-	-
.80	-	-	-		-	-	-	-	-	-	-	-
143.26	-	8		3	-	-	-	-	-	-	-	-
.30	-	571			-		-	-	-	-	-	-
.35	-	33	20		-		-	-	-	-	-	-
.40	-				-		-	-	-	-	-	-
.50	-			-	-		-	-	-	-	-	-
147.20	-	12	3	6	-	-	-	-	-	-	-	-
.25	-	47	72	12	-	-	-	-	-	-	-	-
.30	-		200		-	-	-	-	-	-	-	-
.35	-	-	-		-	-	-	-	-	-	-	-
.40	-		3		-	-	-	-	-	-	-	-
.45	-	-	-		-	-	-	-	-	-	-	-
.50	-	-	-		-	-	-	-	-	-	-	-
.55	-	-	-		-	-	-	-	-	-	-	-
.60	-	-	-		-	-	-	-	-	-	-	-
.70	-	-	-		-	-	-	-	-	-	-	-
.80	-	-	-		-	-	-	-	-	-	-	-
148.20	-	-	-	-	-		-	-	-	-	-	-
.25	-	-	-	-	-		-	-	-	-	-	-
.30	-	-	-	-	-		-	-	-	-	-	-
.40	-	-	-	-	-		-	-	-	-	-	-
.50	-	-	-	-	-		-	-	-	-	-	-
150.16	-	-	-		-	-	-	-	-	-	-	-
.19	-			-	-	-	-	-	-	-	-	-
.20	-	-	-		-	-	-	-	-	-	-	-
.25	-				-	-	-	-	-	-	-	-
.30	-	-	30		-	-	-	-	-	-	-	-
.35	-		-		-	-	-	-	-	-	-	-
.40	-		2		-	-	-	-	-	-	-	-
Total	1278	37998	34589	4047	260	88	16	3	0	0	4	0

Note: No hake found on lines 153 and 157.

RECORD OF THE LARVAE OF ROCKFISH (SEBASTODES SPP.), 1957

Larvae of the genus Sebastodes are grouped together as rockfish larvae. Forty-nine species of rockfish are known to occur off California.

As in previous seasons, rockfish larvae occurred in greatest abundance off southern California (station lines 80-93), as is shown in text table 12, and the following tabulation:

Lines	Total samples taken	Occurrences of rockfish larvae	Percent occurrence	Total number of larvae taken	Percent taken in each area	Average number per haul
60-77	101	68	67.3	3,170	8.7	31.3
80-93	364	228	62.7	23,163	63.5	63.6
97-107	287	90	31.4	3,779	10.4	13.2
110-120	360	109	30.3	4,878	13.4	13.5
123-137	267	63	23.6	1,466	4.0	5.5
140-157	102	3	2.9	17	<0.1	0.2
Total	1,481	561	37.9	36,473	100.0	24.6

Rockfish larvae were more abundant off southern California (station lines 80-93) in 1957 than during the previous two seasons, with respect to both the percentage of the total larvae taken and the absolute number of larvae taken.

Lines	1955		1956		1957	
	Number	Percent	Number	Percent	Number	Percent
60-77	2,893	10.2	1,981	6.8	3,170	8.7
80-93	13,503	47.8	14,674	50.4	23,163	63.5
97-107	3,721	13.2	4,703	16.1	3,779	10.4
110-120	6,336	22.4	6,306	21.6	4,878	13.4
123-137	1,796	6.3	1,424	4.9	1,466	4.0
140-157	24	0.1	56	0.2	17	<0.1
Total	28,273	100.0	29,144	100.0	36,473	100.0

A record of the rockfish larvae taken in each plankton collection made in 1957 is given in table VIII.

Text table 12.--Occurrence and abundance (standard haul totals) of rockfish larvae (Sebastodes spp.), by month and area, in hauls made during 1957

Cruise	Central California 60-77		Southern California 80-93		Northern Baja California 97-107		Upper central Baja California 110-120		Lower central Baja California 123-137		Southern Baja California 140-157		Total	
	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber	occur-rences	num-ber
5701	-	-	-	-	4	213	8	693	6	104	-	-	18	1,010
5702	-	-	26	8,372	10	855	16	1,636	6	138	0	0	58	11,001
5703	-	-	24	3,166	8	841	15	1,778	14	789	1	11	62	6,585
5704	-	-	31	5,760	17	970	17	255	8	234	2	6	75	7,225
5705	20	995	36	2,894	22	579	20	267	8	84	-	-	106	4,819
5706	23	1,293	38	1,282	13	91	11	52	4	24	0	0	89	2,742
5707	23	836	26	385	7	39	8	62	9	61	-	-	73	1,383
5708	-	-	-	-	-	-	5	34	3	13	-	-	8	47
5709	-	-	-	-	-	-	4	16	3	12	-	-	7	28
5710	-	-	15	184	4	22	4	18	2	7	-	-	25	231
5711	2	46	20	483	3	57	-	-	-	-	-	-	25	586
5712	-	-	12	637	2	112	1	67	-	-	-	-	15	816
Total	68	3,170	228	23,163	90	3,779	109	4,878	63	1,466	3	17	561	36,473
Percent		8.69		63.51		10.36		13.37		4.02		0.05		100.00

Table VIII

Record of the larvae of rockfish (Sebastodes spp.), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
60.50	-	-	-	-	18		NQ	-	-	-	-	-
.55	-	-	-	-	34	12	81	-	-	-	-	-
.60	-	-	-	-	71	3	46	-	-	-	-	-
.70	-	-	-	-	14	45	72	-	-	-	-	-
.80	-	-	-	-		47	-	-	-	-	-	-
.90	-	-	-	-			-	-	-	-	-	-
63.52	-	-	-	-	78	152	21	-	-	-	-	-
.55	-	-	-	-	110	255	101	-	-	-	-	-
.60	-	-	-	-	33	143	43	-	-	-	-	-
.70	-	-	-	-		27	49	-	-	-	-	-
.80	-	-	-	-		4	4	-	-	-	-	-
.90	-	-	-	-	-		-	-	-	-	-	-
67.50	-	-	-	-	23	105	NS	-	-	-	-	-
.55	-	-	-	-		45	140	-	-	-	-	-
.60	-	-	-	-	46	42	17	-	-	-	-	-
.70	-	-	-	-	12		8	-	-	-	-	-
.80	-	-	-	-		3	6	-	-	-	-	-
.90	-	-	-	-	-		-	-	-	-	-	-
70.52	-	-	-	-	70		87	-	-	-	-	-
.55	-	-	-	-				-	-	-		-
.60	-	-	-	-	17	19	7	-	-	-		-
.70	-	-	-	-	67	36	4	-	-	-		-
.80	-	-	-	-			-	-	-	-		-
.90	-	-	-	-	3	6	-	-	-	-	-	-
73.50	-	-	-	-	18	21	5	-	-	-	27	-
.55	-	-	-	-	37	124	41	-	-	-	19	-
.60	-	-	-	-	123	60	6	-	-	-		-
.70	-	-	-	-		19	30	-	-	-	-	-
.80	-	-	-	-		22	-	-	-	-	-	-
.90	-	-	-	-	-		-	-	-	-	-	-
77.50	-	-	-	-	33		3	-	-	-	-	-
.55	-	-	-	-	75	84	3	-	-	-	-	-
.60	-	-	-	-	113	19	43	-	-	-	-	-
.70	-	-	-	-			19	-	-	-	-	-
.80	-	-	-	-				-	-	-	-	-
.90	-	-	-	-	-			-	-	-	-	-

Table VIII (cont'd)

Record of the larvae of rockfish (Sebastodes spp.), 1957

Station	Cruise and month 5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
80.51	-	178	9	34				-	-		-	18
.55	-	3659	94	268	11		34	-	-	12	34	273
.60	-	639	24	68		22	32	-	-	3	26	33
.70	-	22			57	13		-	-		3	27
.80	-					6		-	-	NS	-	
.90	-	12						-	-		-	3
82.47	-	32	52	113	252	7	40	-	-		19	-
83.40	-	67	6	8			2	-	-		4	-
.43	-	144	8	66	20	5	6	-	-	11	28	-
.48	-	-	217	-	-	-	-	-	-	-	-	-
.51	-	1483	-	207	66	39	17	-	-	6	33	-
.52	-	401	321	-	-	-	-	-	-	-	-	-
.55	-	-	-	-	109		11	-	-	-		-
.60	-	14		60	6	24	27	-	-			-
.65	-	-	-	-	-	3		-	-	-	-	-
.70	-	-						-	-		-	-
.75	-	-	-	-	-	42		-	-	-	-	-
.80	-	-	-		14	13		-	-		-	-
.85	-	-	-	-	-			-	-	-	-	-
.90	-	-	-				NS	-	-		-	3
86.46	-	49	-	192	-	-	-	-	-	-	-	-
87.35	-	69	156	141	41			-	-	3	4	-
.38	-	61	-	-	-	-	-	-	-	-	-	-
.40	-	147	287	49	70	24	NS	-	-		4	-
.45	-	-	69	-	306	29		-	-	3	4	-
.50	-	270	502	1596	26	121	7	-	-	22	191	-
.55	-	20	-	-	6	57	6	-	-	5	23	-
.60	-	226		48	131	54	5	-	-	3	34	-
.65	-	-	-	-		83	10	-	-	-	-	-
.70	-		12	23		143	56	-	-		-	-
.75	-	-	-	-		24		-	-	-	-	-
.80	-	-	-	26			NS	-	-		-	-
.85	-	-	-	-	14			-	-	-	-	-
.90	-	-	-		3	9		-	-		-	
90.28	-	99	241	62	3	8	28	-	-			36
.30	-	50	433	110	4	16		-	-		3	4
.37	-		72	136	13	13		-	-	7		
.45	-	437	18	171	5	29	9	-	-		9	22

Table VIII (cont'd)

Record of the larvae of rockfish (Sebastodes spp.), 1957

	Cruise and month											
Station	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
90.50	-	-	-	-	177	7		-	-	56	14	212
.55	-			298	1017	56	9	-	-	33	30	
.60	-	18	17	12		94	19	-	-	10		
.65	-	-	-	-	9	84	5	-	-	-	-	-
.70	-			64		116	6	-	-		-	
.75	-	-	-	-		45	5	-	-	-	-	-
.80	-		57			3	31	-	-		-	3
.85	-	-	-	-			3	-	-	-	-	-
.90	-			20	12	3		-	-		-	3
93.27	-	149	192	19	18			-	-		11	-
.30	-	27	77	68	8		8	-	-			-
.35	-	-	-	51	27	18		-	-	4		-
.40	-		6	200	19	6	3	-	-	6	3	-
.45	-	-	-	408	3			-	-	-		-
.50	-	86	277	671	18	3	3	-	-		6	-
.55	-	-	-	514	180	3	3	-	-	-		-
.60	-	13	19	57	15	15		-	-			-
.65	-	-	-	-	67	37		-	-	-	-	-
.70	-				152	8		-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-	-	-	NS				-	-		-	-
.85	-	-	-	-	3			-	-	-	-	-
.90	-	-	-		12			-	-		-	-
97.30	-	61	486	135	103	6	8	-	-	4	13	-
.32	-		-	57	22		2	-	-		39	85
.35	-	-	-	-	-	-	-	-	-	4	-	-
.40	-		90		4	3		-	-		5	-
.45	-	-	-	61	3		8	-	-	-		-
.50	-			NS	6		13	-	-			-
.55	-	-	-	NS	143			-	-	-		-
.60	-	26	-	13		9		-	-			-
.65	-	-	-	-		4		-	-	-	-	-
.70	-		-	8				-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-	-	-					-	-		-	-
.85	-	-	-	-				-	-	-	-	-
.90	-	-	-		8			-	-		-	-

Table VIII (cont'd)

Record of the larvae of rockfish (Sebastodes spp.), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
100.29	-	271	35	52	9	12		-	-		-	-
.30	-	-	-	-	-	-	-	-	-	6	-	-
.33	-	90	3	84	26	6		-	-	-	-	-
.35	-	-	-	-	-	-	-	-	-		-	-
.40	-	67		44	89			-	-		-	27
.45	-	-	-	6	6			-	-	-	-	-
.50	-				12	12		-	-		-	-
.55	-	-	-	17	14	7		-	-	-	-	-
.60				101	33	3		-	-		-	-
.65	-	-	-	-				-	-	-	-	-
.70	-		-				-	-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-		-				-	-	-		-	-
.85	-	-	-	-		6	-	-	-	-	-	-
.90	-		-				-	-	-		-	-
103.30	103	190	38	83	14	17	2	-	-	8	-	-
.35	61	111	9		7		3	-	-		-	-
.38			-	-	-	-	-	-	-	-	-	-
.40					3			-	-		-	-
.45	-	-	-		20			-	-	-	-	-
.50					18	3		-	-		-	
.55	-	-	-	3				-	-	-	-	-
.60			NS				3	-	-		-	-
.65	-	-	-	-				-	-	-	-	-
.70	-							-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-	-	-				-	-	-		-	-
.85	-	-	-	-			-	-	-	-	-	-
.90	-	-	-				-	-	-	-	-	-
107.32	46	24*	133	32	28	-		-	-	NQ	-	-
.35				244	4	3		-	-		-	-
.40	3			27	7			-	-		-	-
.45	-	-	-	3				-	-	-	-	-
.50								-	-		-	-
.55	-	-	-					-	-	-	-	-
.60		6						-	-		-	
.65	-	-	-	-				-	-	-	-	-
.70	-	9	47					-	-		-	-

* - Samples combined. Values adjusted accordingly.

Table VIII (cont'd)

Record of the larvae of rockfish (Sebastodes spp.), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
107.75	-	-	-	-				-	-	-	-	-
.80	-	-	-					-	-		-	-
.85	-	-	-	-				-	-	-	-	-
.90	-	-	-					-	-	-	-	-
110.33	-	63	58		8	6	14	11	2	9	-	-
.35	-	12	432	6	12						-	-
.40		3		49							-	-
.45	-	-	-	33	15			-	-	-	-	-
.50				3	9		3	-	-		-	-
.55	-	-	-		3	10		-	-	-	-	-
.60				3				-	-		-	-
.65	-	-	-	-				-	-	-	-	-
.70	-			10				-	-		-	67
.75	-	-	-	-				-	-	-	-	-
.80	-		-					-	-		-	-
.85	-	-	-	-				-	-	-	-	-
.90	-		-					-	-	-	-	-
113.30	70	317	163	26	9	2	8				-	-
.35	8	70	228			3	8	3	3		-	-
.40		8	14	9							-	-
.45	-	-	-			3		-	-	-	-	-
.50			3					-	-		-	-
.55	-	-	-					-	-	-	-	-
.60								-	-	3	-	-
.65	-	-	-	-	5			-	-	-	-	-
.70								-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-	-	-	3				-	-		-	-
.85	-	-	-	-	-		-	-	-	-	-	-
.90	-	-	-	-	-		-	-	-	-	-	-
115.27	-	-	-	-	-	-	-			-	-	-
.30	-	-	-	-	-	-	-			-	-	-
.35	-	-	-	-	-	-	-			-	-	-
.40	-	-	-	-	-	-	-		3	-	-	-
117.26	426	132		8	7				8	3	-	-
.30	127	568	111	27	23						-	-
.35		246	69	11	8	7					-	-
.40	43	7	30	10	44			3			-	-

Table VIII (cont'd)

Record of the larvae of rockfish (Sebastodes spp.), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
107.45	-	-	-		32	1		-	-	-	-	-
.50	8	6	343		8			-	-	3	-	-
.55	-	-	-		24			-	-	-	-	-
.60			25		3			-	-		-	-
.65	-	-	-	-				-	-	-	-	-
.70								-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-	-	-					-	-		-	-
.85	-	-	-	-	-		-	-	-	-	-	-
.90	-	-	-	-	-		-	-	-	-	-	-
118.39	-	-	76	11	27			-	-		-	-
118.25	-	-	-	-	-	-	-			-	-	-
.30	-	-	-	-	-	-	-	10		-	-	-
.35	-	-	-	-	-	-	-			-	-	-
119.33	-	-	136		5	11	10				-	-
120.25		30	6	2		2					-	-
.30	5	117	84				13	7			-	-
.35		44					3				-	-
.40		7		-	2	4					-	-
.45	6	6	-	-	10	3					-	-
.50			-	23	13			-	-		-	-
.55			-	21				-	-	-	-	-
.60								-	-		-	-
.65	-	-	-	-				-	-	-	-	-
.70							3	-	-		-	-
.75	-	-	-	-				-	-	-	-	-
.80	-							-	-		-	-
.85	-	-	-	-	-		-	-	-	-	-	-
.90	-	-	-	-	-		-	-	-		-	-
123.37	12	32	418		33	6	3		3		-	-
.42	11		48		3			3			-	-
.45	-	-	-	-	-	-	-			-	-	-
.50				20	-			-	-		-	-
.55	-			8	-			-	-	-	-	-
.60		4			-			-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	-		-	-		-	-		-	-

Table VIII (cont'd)
Record of the larvae of rockfish (Sebastodes spp.), 1957

Station	Cruise and month 5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
127.34	12	8	92	5	3					3	-	-
.40	60		8				6	7			-	-
.45	-		22								-	-
.50			6		-			-	-		-	-
.55	-				-			-	-	-	-	-
.60			3		-			-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	-		-	-		-	-		-	-
130.30			32	5	3				5		-	-
.35		65			24						-	-
.40	6	10						3			-	-
.45	-	-	-		-		3			-	-	-
.50								-	-		-	-
.55	-	-	-		-			-	-	-	-	-
.60								-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	—		-	-		-	-	4	-	-
133.25	3		10		9		11				-	-
.30		19	33				20		4		-	-
.35		-		170	-	10	3	-	-		-	-
.40						5		-	-		-	-
.45	-	-	-		-			-	-	-	-	-
.50	-				6	3		-	-		-	-
.55	-	-	-		-	-	-	-	-	-	-	-
.60	-	-	-		-	-		-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	-		-	-		-	-		-	-
137.23							11				-	-
.30			6	13	3						-	-
.35			88	-	-		4	-	-		-	-
.40	-		20	10	NS			-	-		-	-
.45	-	-	-		-			-	-	-	-	-
.50	-		3	3				-	-		-	-
.55	-	-	-		-	-	-	-	-	-	-	-
.60	-	-	-		-	-		-	-		-	-
.70	-	-	-		-	-		-	-		-	-
.80	-	-	-		-	-		-	-		-	-

Table VIII (cont'd)

Record of the larvae of rockfish (Sebastodes spp.), 1957

Station	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
140.30	-				-		-	-	-	-	-	-
.35	-		11		-		-	-	-	-	-	-
.40	-			4	-		-	-	-	-	-	-
.45	-	-	-		-	-	-	-	-	-	-	-
.50	-				-		-	-	-	-	-	-
.55	-	-	-		-	-	-	-	-	-	-	-
.60	-	-	-		-	-	-	-	-	-	-	-
.70	-	-	-		-	-	-	-	-	-	-	-
.80	-	-	-		-	-	-	-	-	-	-	-
143.26	-				-	-	-	-	-	-	-	-
.30	-				-		-	-	-	-	-	-
.35	-			2	-		-	-	-	-	-	-
.40	-				-		-	-	-	-	-	-
.50	-			-	-		-	-	-	-	-	-
147.20	-				-	-	-	-	-	-	-	-
.25	-				-	-	-	-	-	-	-	-
.30	-				-	-	-	-	-	-	-	-
.35	-	-	-		-	-	-	-	-	-	-	-
.40	-				-	-	-	-	-	-	-	-
.45	-	-	-		-	-	-	-	-	-	-	-
.50	-	-	-		-	-	-	-	-	-	-	-
.55	-	-	-		-	-	-	-	-	-	-	-
.60	-	-	-		-	-	-	-	-	-	-	-
.70	-	-	-		-	-	-	-	-	-	-	-
.80	-	-	-		-	-	-	-	-	-	-	-
148.20	-	-	-	-	-		-	-	-	-	-	-
.25	-	-	-	-	-		-	-	-	-	-	-
.30	-	-	-	-	-		-	-	-	-	-	-
.40	-	-	-	-	-		-	-	-	-	-	-
.50	-	-	-	-	-		-	-	-	-	-	-
150.16	-	-	-		-	-	-	-	-	-	-	-
.19	-			-	-	-	-	-	-	-	-	-
.20	-	-	-		-	-	-	-	-	-	-	-
..25	-				-	-	-	-	-	-	-	-
.30	-	-			-	-	-	-	-	-	-	-
.35	-		-		-	-	-	-	-	-	-	-
.40	-				-	-	-	-	-	-	-	-
Total	1010	11001	6585	7225	4819	2742	1383	47	28	231	586	816

Note: No rockfish found on lines 153 and 157.

LITERATURE CITED

AHLSTROM, ELBERT H.

1948. A record of the pilchard eggs and larvae collected during surveys made in 1939 to 1941. U. S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Rept. No. 54, 76 pp.

1952. Pilchard eggs and larvae and other fish larvae, Pacific coast, 1950. U. S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Rept. : Fisheries No. 80, 58 pp.

1953. Pilchard eggs and larvae and other fish larvae, Pacific coast, 1951. U. S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Rept. : Fisheries No. 102, 55 pp.

1954a. Pacific sardine (pilchard) eggs and larvae and other fish larvae, Pacific coast - 1952. U. S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Rept. : Fisheries No. 123, 76 pp.

1954b. Distribution and abundance of egg and larval populations of the Pacific sardine. U. S. Dept. Interior, Fish and Wildlife Service, Fish. Bull. 93, vol. 56, pp. 83-140.

1958. Sardine eggs and larvae and other fish larvae, Pacific coast, 1956. U. S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Rept. : Fisheries No. 251, 84 pp.

AHLSTROM, ELBERT H., and D. KRAMER

1955. Pacific sardine (pilchard) eggs and larvae and other fish larvae, Pacific coast, 1953. U. S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Rept. : Fisheries No. 155, 74 pp.

1956. Sardine eggs and larvae and other fish larvae, Pacific coast, 1954. U. S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Rept. : Fisheries No. 186, 79 pp.

1957. Sardine eggs and larvae and other fish larvae, Pacific coast, 1955. U. S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Rept. : Fisheries No. 224, 90 pp.

THRAILKILL, JAMES R.

In Press. Zooplankton volumes off the Pacific coast, 1957. U. S. Dept. Interior, Fish and Wildlife Service, Spec. Sci. Rept. : Fisheries.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1960 O - 539030